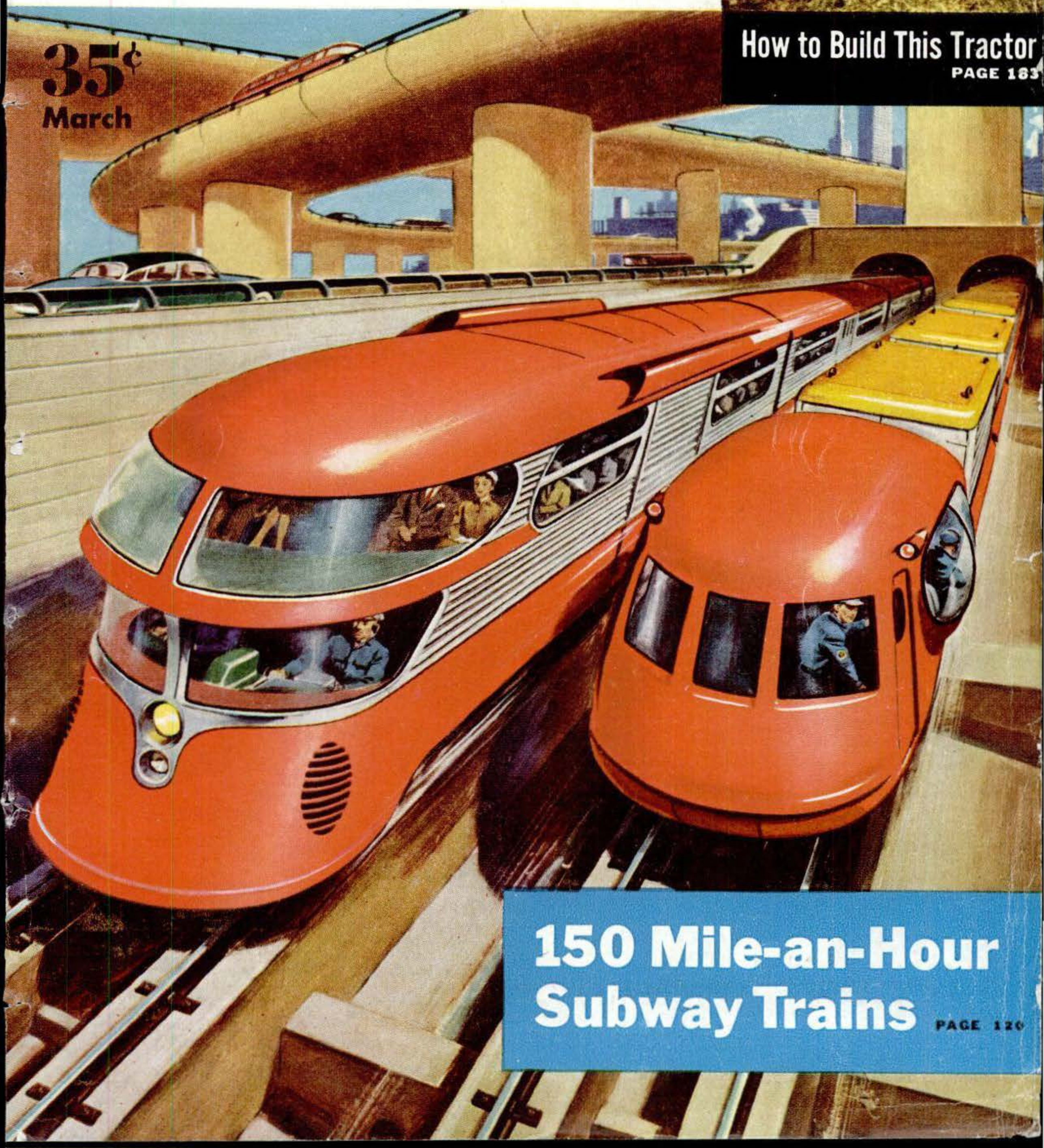
POPULAR SCIENCE

MONTHLY

MECHANICS - AUTOS - HOMEBUILDING

How to Build This Tractor
PAGE 183

35¢
March



150 Mile-an-Hour Subway Trains PAGE 120

How Any Car Owner With "HANDY GUIDE

Shows 101 Ways to SAVE MONEY!
On Gas — Oil — Tires — Insurance
Repairs — Service — Beautifying —
Buying – Selling – Trading-in – and More!

General Editor! Frank Mitchell, famous as car owner's friend and instructor in auto repair, heads staff of practical writers and artists who make contents easy to follow.

HERE IT IS! The *first* book ever published with the primary purpose of telling everything the average car owner needs to know to SAVE MONEY — to keep his car purring like a kitten.

This all-brand-new book is NOT a collection of highly technical diagrams for the mechanical wizard. It IS an exciting picture-filled book crammed with easy step-by-step instructions and common-sense guidance which you can understand and use *right away* to SAVE MONEY!

If you're an average car owner, driving 6000 to 10,000 miles a year, you spend about $400 for Gas, Oil, Repairs, Servicing, Tires, Insurance, *etc.* This amazing NEW book shows you how to SAVE at least $100 of that figure — EVERY year! Big savings even for drivers who don't touch tools!

SAVE when Buying Used Car!

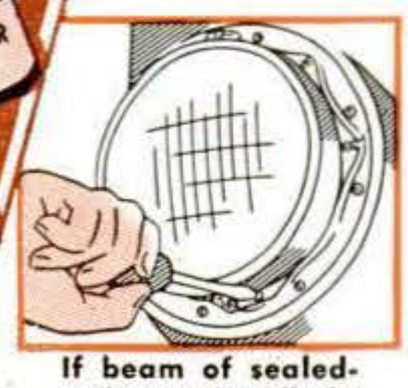
Special Check List takes gamble out of used car buying. Shows you point by point how to tell good sound car from "lemon"!

Enjoy Week's Trial

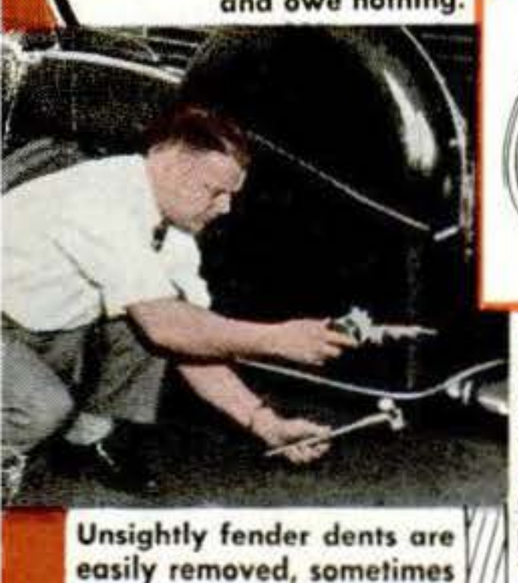
FREE

Under this Amazing Savings Guarantee!

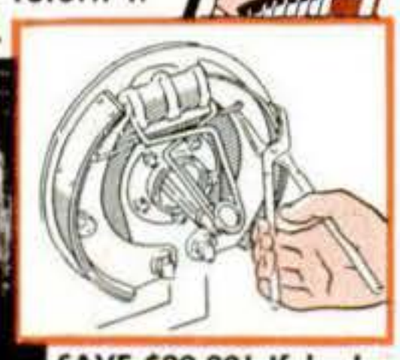
Test book 7 days at our expense. If not convinced it will help you save $100.00 a year, return it and owe nothing.



If beam of sealed-reflector headlight goes out, you may not need costly new unit. Corroded contacts may be preventing lamp from lighting. To restore light, merely clean contacts.



Unsightly fender dents are easily removed, sometimes pop right out after few taps from hammer. Just one of scores of repair jobs any amateur can easily do.



SAVE $20.00! If brake pedal is hard to press, goes down to floor, brakes squeak, you need brake adjustment or relining. Book explains steps. *(Here)* How to remove pull back spring from shoe. Book shows 101 ways to Save Money — even if you don't touch tools.

SAVE $3.00 to $4.00! Install fuel pump yourself. Tilt as shown and position pump arm so it will ride in proper place on camshaft.

SAVE by cleaning air filter. Remove filter element as shown, wash in gasoline, dip in engine oil, drain and replace. Check cleaner every 1000 miles. Cleaning oil and gas filters is just as easy.

512 Big Double-Column Pages of Step-by-Step Instructions Anyone Can Understand!

101 Ways to Save on Service, Maintenance, and Repair of Your Car!

Book Crammed with Show-How Pictures, Charts, Diagrams!

Full Library-Size — In Sturdy Washable Binding

Here's Partial List of Vast

More Miles for Less Gas

20 Sure Ways to Get More Gas Mileage
How to Remove, Clean Out and Replace Gas Tank
Adjust Carburetor
How to Repair Clogged Line
And Lots MORE!

Body and Fender

How to Repair Dents, Match Colors, Touch Up Paint, Treat Surface Scratches, Rust Spots, Etc.
How to Give Car Mirror-Like Finish
And Much MORE!

Lubrication

10 Sure Ways to Save Oil
How to Prevent Oil Dilution
How to Trace and Correct Leaks
How to Install Oil Pump Line
Undercoating
And MORE!

Save on Tires

14 Common Sense Ways to Get More Mileage on Tires
Blowout Protection
How to Cross-Switch Tires
Wheel Balance, Front End Checks
And Much MORE!

Specifications

For Every Popular Make Car — As Far Back as 1935!

Rely on Brakes

How to Make Fast Brake-Safety Test
How to Adjust and Re-Line Brakes
Lots MORE!

Auto Insurance

Everything Average Car Owner Needs to Know about All Types
And Much MORE!

Learn the Easy Best Way to:

ADD up to $300.00 to Resale Price of Car. How to Get a Better Deal on Trade-In!

TRACE Cause of Starting Troubles Fast!

TIGHTEN Loose Steering, Correct Wobbly Wheels. Safeguard Your Life and Those Who Ride with You!

KEEP Car "Tuned-Up" to Smooth Running Performance — Whether New or Old!

GIVE Your Car Faster Pick-Up and "Go"

PROTECT Engine Parts from Rust and Corrosion. Clean Gas, Oil, Water Lines.

BEWARE of "Miracle Gas and Oil Savers" on Market. Some May be Harmful to Car!

SAVE $15.00 Winterizing, Summerizing!

SAVE $40.00! Hammer Out Dents Yourself!

SAVE $1.00 Installing New Fan Belt!

SAVE up to $90.00 on Ring, Valve and Bearing Job!

SAVE $100.00 on Service, Maintenance and Running of Your Car — Even if You Make No Repairs Yourself!

Interior Beauty

How to Re-upholster, Make Seat Covers, Remove Stains
Dashboard Instruments: Assembly, Repair, Disassembly
And Lots MORE!

Exhaust System

Disassembly, Adjustment and Assembly of: Muffler, Exhaust Pipe, Manifold Pipe
How to Repair Leak from Exhaust or Intake Manifolds
And Lots MORE!

Claim Valuable FREE GIFT! Mail Coupon TODAY!

May Save $100.00 a Year-or More!

the Aid of FOR CAR OWNERS"

How to Get 2 to 5 More Miles on a Gallon! Up to Double Mileage on Tires! Do Your Own Repairs! Add Longer Life, Greater Value, More Power! *No Magic Miracles! Just Plain Common Sense!*

Car owner making one-minute adjustment of carburetor idling screw for more gas mileage. He will also clean spark plugs and set points to prescribed clearance. Then by following simple gas-saving driving rules and other common sense ways to save on gas, he'll save up to $50.00 a year on gasoline alone!

A Few of the 101 Savings

SAVE up to $50.00 on Gas! Learn 20 SURE WAYS to get from 2 to 5 *more* miles on every gallon!

SAVE on Oil! 11 ways show how to save up to 50% on oil bills!

SAVE on Tires! 14 common sense ways show you how!

SAVE on Auto Insurance! Everything you need to know about all types. How to Collect Faster!

SAVE on Repair Bills! Book's basic know-how helps you service and repair every popular make car — as far back as 1935 models.

SAVE — Even if You Make No Repairs Yourself! Book lists fair price mechanic should charge for over 100 repair and service jobs. Protects you from bill padding and overcharging!

FREE GIFT!

MIRACLE CLOTH CAR POLISHER. Science's amazing new boon for car owners! Polishes without wax or hard rubbing. Just wipe and see mirror-like gleam appear; resists sun, rain, dust, and grime. *Not $2.00—yours FREE for merely examining book!*

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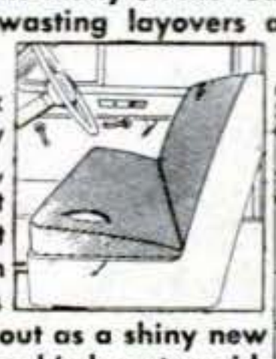
But first, week's FREE Trial must convince you book will help you save at least $100.00 a year — EVERY year — or return it and owe nothing. Send NO money. *Mail FREE-Trial Coupon NOW!*

Even an amateur can patch muffler with aid of book's "1-2-3" directions. Clean area, place steel patch over hole and seal.

Save on Auto Insurance! Best type to carry; recommended amount; how to collect damages without red tape; *much more!*

SAVE $10.00 to $25.00 towing fees! TROUBLE SHOOTER Section helps you trace trouble fast— fix it right and quick. Make many on-the-road emergency repairs in minutes. Avoid time-wasting layovers at unknown garages along the road.



Beautify inside to look like new! Book shows how to re-upholster, refinish, remove stains, make seat covers, etc. Enjoy that feeling of satisfaction in knowing your car looks as spic and span inside and out as a shiny new showroom model. With book's how-to guidance, you can make your car look better, run better, last longer! Mail FREE-Trial Coupon Now!

Money-Saving Contents Crammed into Book!

Engine Tune-Up

Testing; Adjusting; Cleaning; Using Solvent; Battery; Wiring; Vacuum Advance; Firing Order; Spark Plugs; Points, Carburetion; Automatic Choke, Generator
And Lots MORE!

Cooling System

How to Repair Clogged Radiator; Leaky Water Pump; Broken Thermostat
Installing Fan Belt
How to Winterize, Summerize
Anti-Freeze Tips
And So Much MORE!

For faster pick-up, smoother riding and more gas mileage, clean and adjust distributor points several times a year. Book shows how.

Auto Wiring

Battery Care
How to Repair Shorts and Breaks
How to Repair or Replace Heaters
Directional Signals, Headlights, Inside Lights
And Lots MORE!

Front End Repair

Disassembly, Adjustment and Assembly of: King Pins, Pitman Arm, Front Wheels, Shock Absorbers, Transmission, Etc.
And Lots MORE!

TROUBLE-SHOOTER SECTION Shows You How to Correct All 64 Most Common Car Troubles Fast and Easy!

How many of these troubles are robbing you of top performance and enjoyment from your car? Engine Won't Start — Misses — Knocks — Overheats — Backfires — Stalls Frequently — Gears Grind — Car Pulls to One Side — Annoying Squeaks — Strange Noises — Sluggish Pick-Up — Horn Keeps Blowing — Defroster Doesn't Clear Windshield — Etc., Etc.

Big, handy TROUBLE-SHOOTER SECTION shows you how to quickly locate and correct these and *all 64* most common car troubles — without paying high labor costs. Especially valuable when making on-the-road repairs. Save high towing charges and repair bills from strange garages.

Major Engine Repair

Disassembly, Adjustment and Assembly of: Connecting Rod Bearings and Main Bearings
How to Remove and Replace: Piston Rings, Cylinder Head, Crankcase, Hoses and Gaskets, Removing Carbon
And Much MORE!

Valves

Disassembly, Adjustment and Assembly of: Valve Plates, Valves (in Block), Overhead Valves, Valve Springs
Valve Timing
Valve Grinding
Tappet Clearance
Sticking or Leaky Valves
And Lots MORE!

Steer Clear of Trouble

How Much Play Is Too Much?
How to Tighten Loose Steering; Adjust Wheel Alignment
And Much MORE!

Rear End Repairs

Disassembly, Adjustment and Assembly of: Rear Wheels, Drums, Axle, Bearing, Universals, Etc.
And Much MORE!

Other Engine Repair

How to Repair Leak in Head Gasket
Replace Fuel Pump
Adjust, Repair, Replace Carburetor
Spark Plugs: How to Test, Clean, Replace and Get Correct Clearance
How to Test Piston Rings, Ignition
And Much MORE!

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POPULAR SCIENCE

REG. U. S. PAT. OFF. *Monthly*

Mechanics and Handicraft
REG. U.S. PAT. OFF.

March, 1954

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They Like Ike's Atomic Ideas

When President Eisenhower dramatically proposed (right) to the United Nations that an international bank of fissionable materials be created for peaceful uses, POPULAR SCIENCE MONTHLY *promptly rounded up some nuclear scientists and asked them what they thought of the idea. Their inspiring reactions, transcribed from magnetic tape, are reported in the article, "If Atomic Fuel Were Shared," beginning on page 101.*

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2 Chrome plated rings retard wear

3 Therefore TOP rings must be chrome plated to → ← retard cylinder wear

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2 in 1 chrome piston rings

*Deductive reasoning

The standard of comparison

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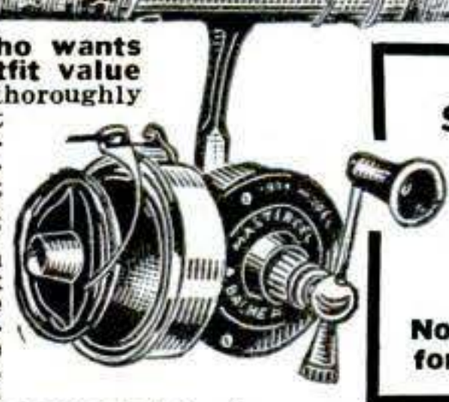

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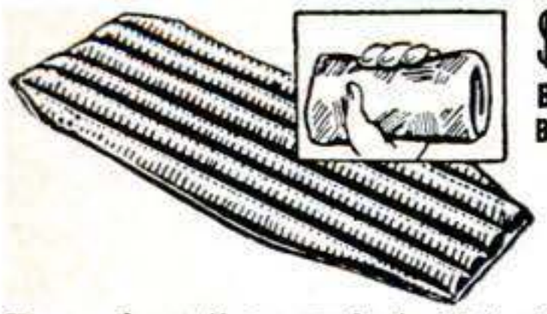

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Meet Our Railroad Expert

HENRY COMSTOCK, who illustrated and wrote "Catching the 8:05 Could Be a Thrill" on page 120, has been an iron-horse enthusiast ever since he listened to the gossip of his grandparents — railroad telegraphers both. A writer and editor, as well as an artist, Comstock has written many articles on railroading and done the pictures for many of them. For nine years he was the editor of *Railroad Magazine.* Since 1952 he has been an associate editor of POPULAR SCIENCE MONTHLY, and its foremost railroad expert.

One night recently a neighbor of Comstock's phoned to say he had heard a passing train make a funny noise. Comstock joined in investigating and found a broken rail. While the neighbor went to phone, Comstock flagged down a passenger train and a fast freight. What surprised their grateful crews was the expert way he did this too—with the standard "washout" signal, a light waved back and forth horizontally across the track.

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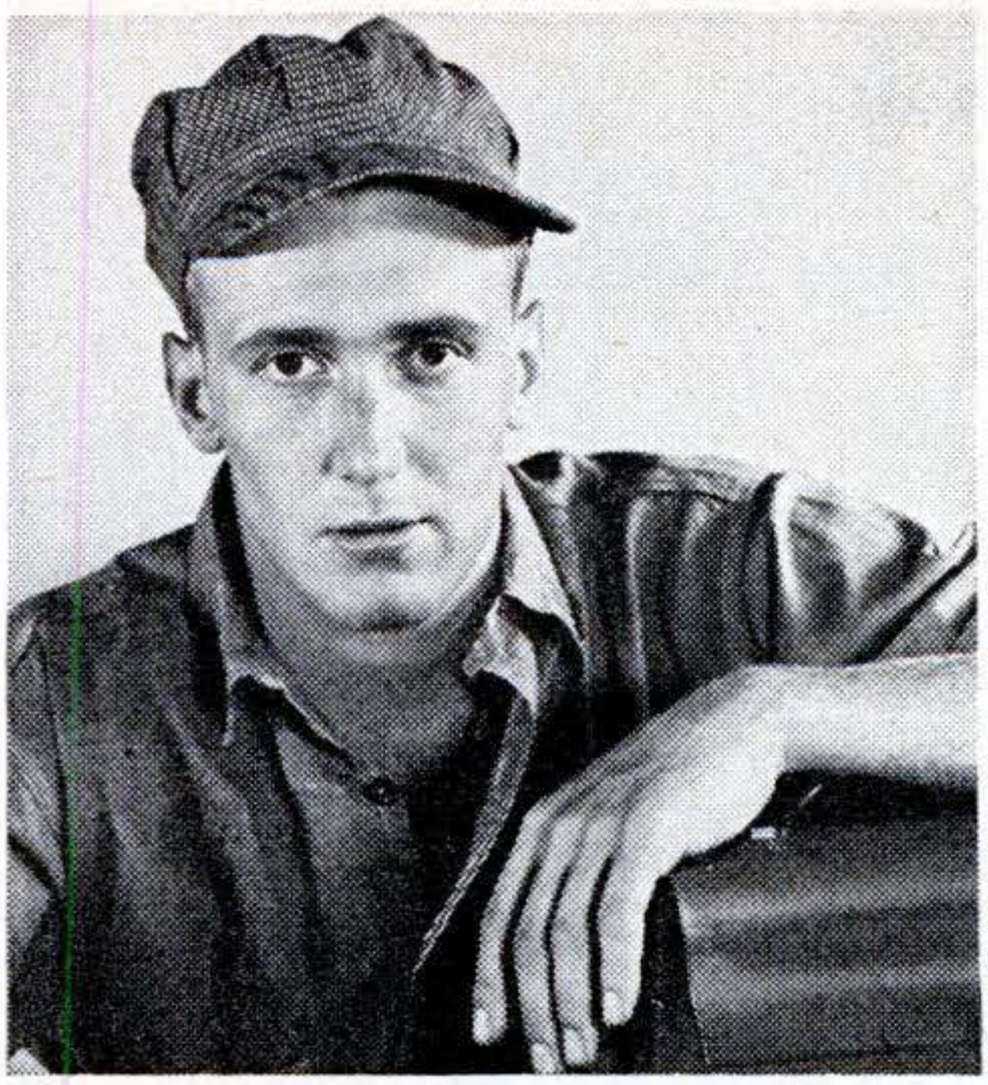
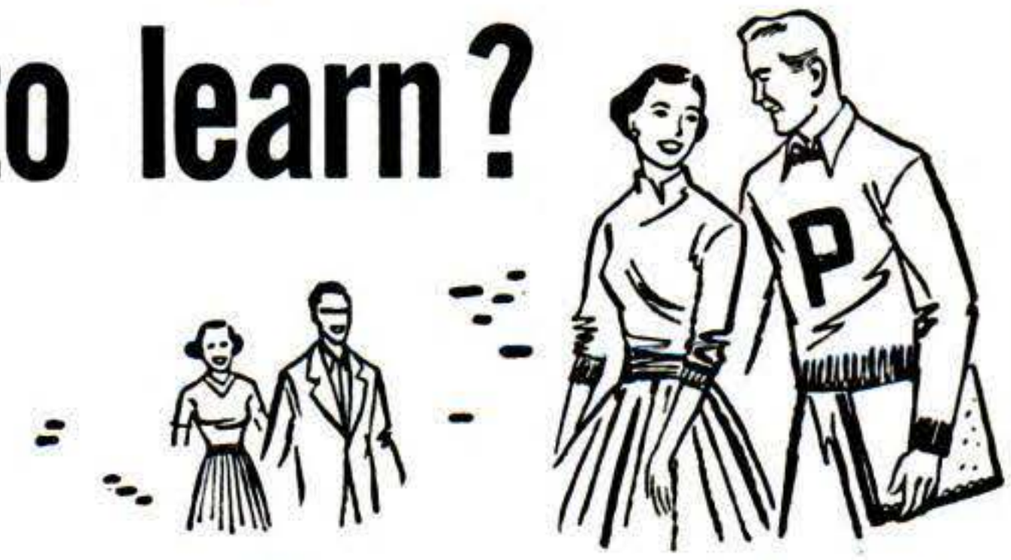


Are you too old to learn?



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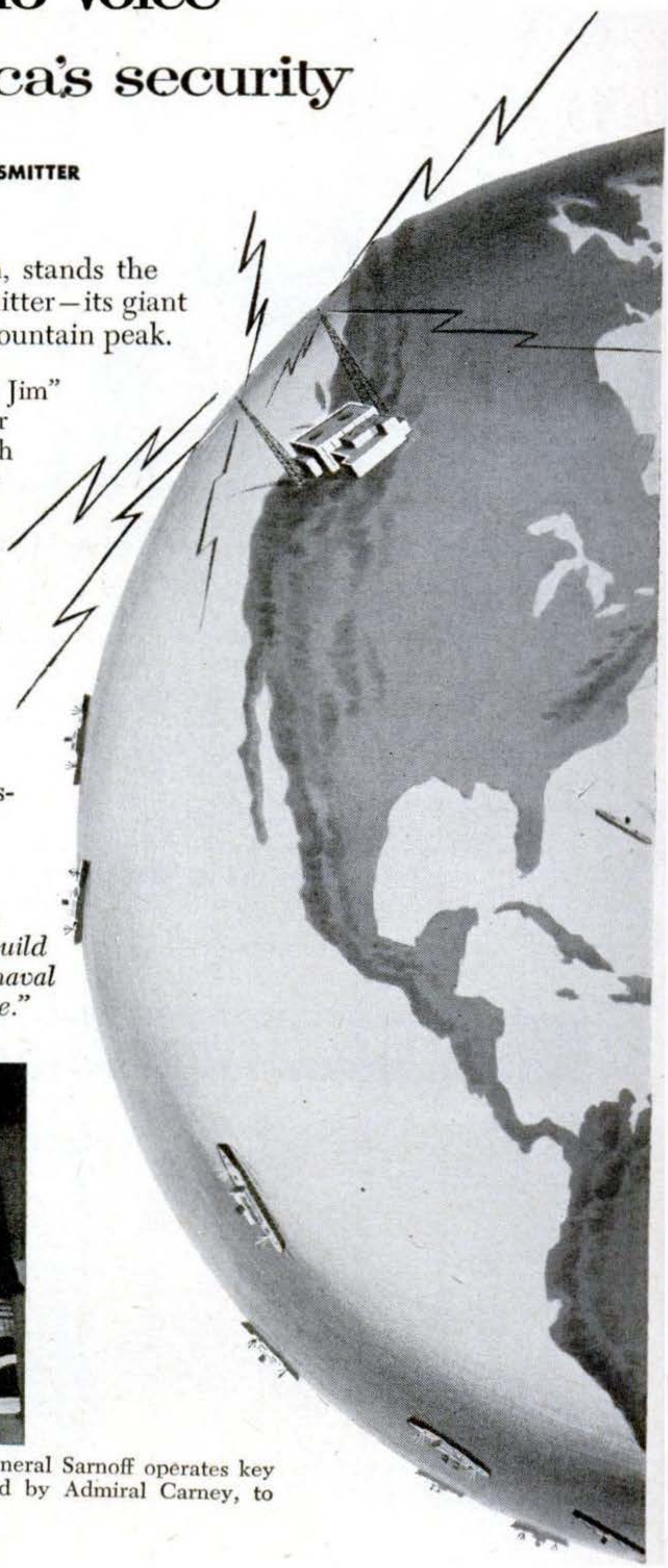

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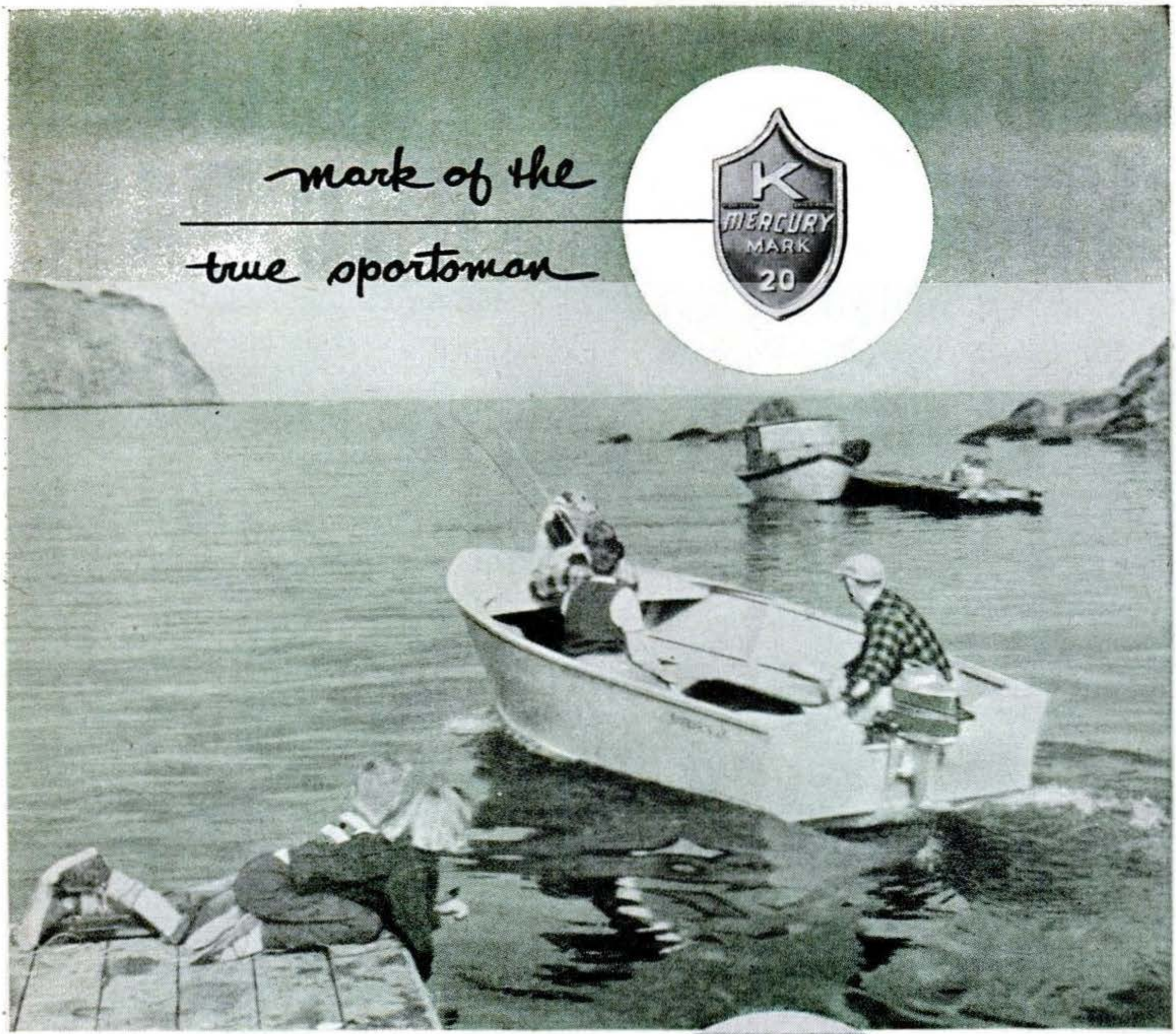

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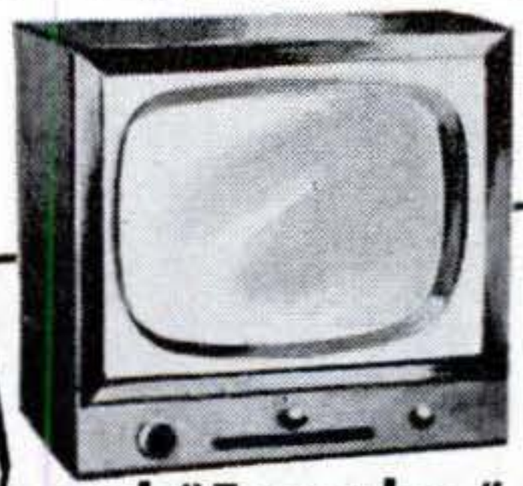

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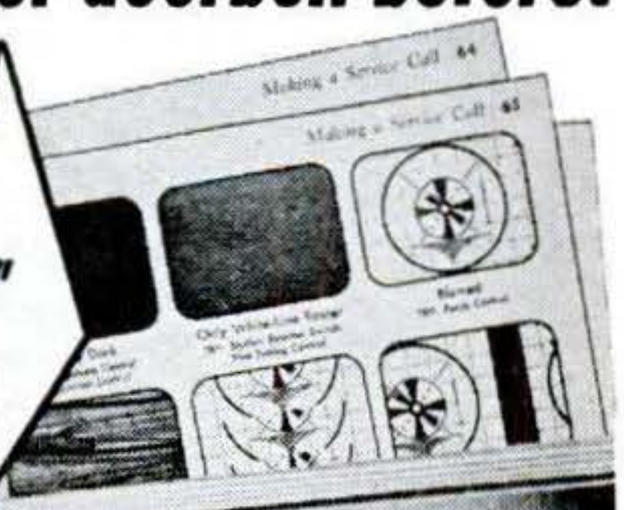

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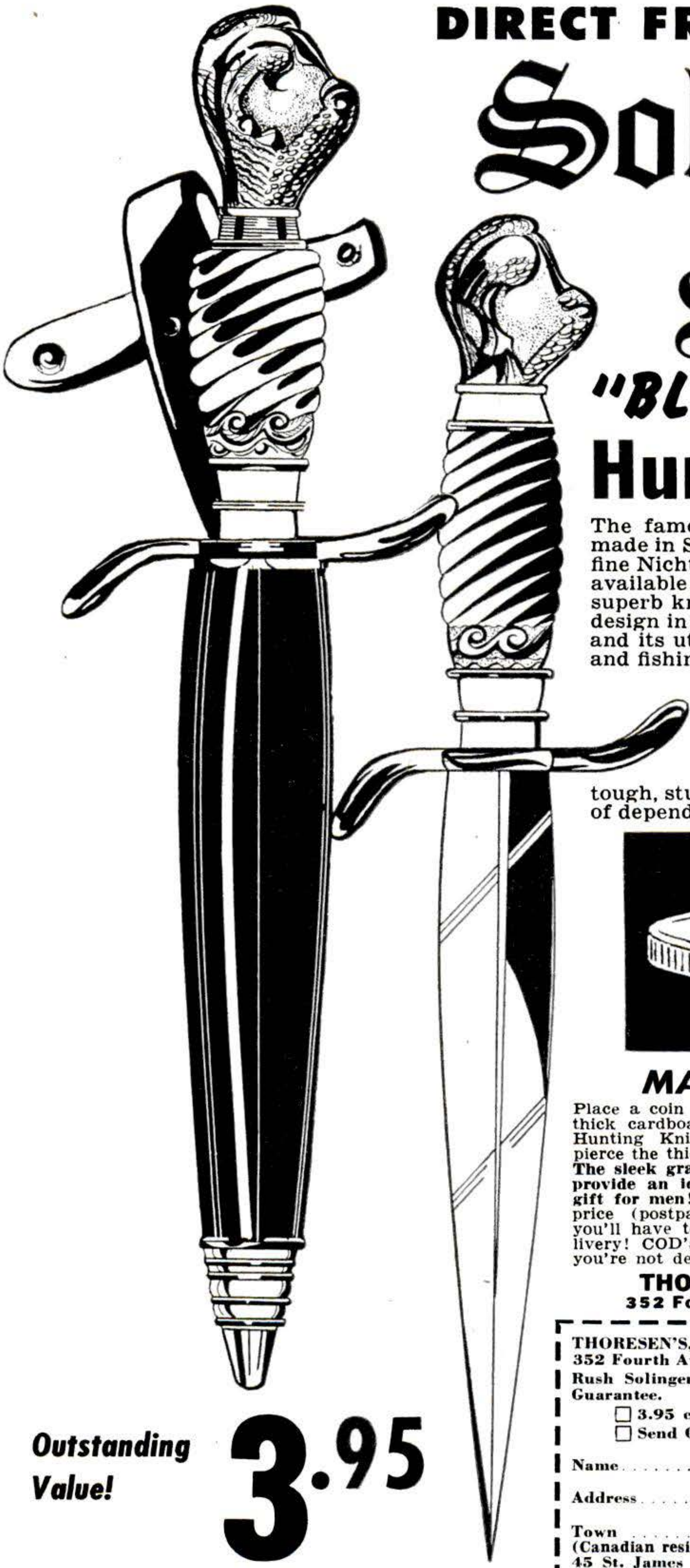

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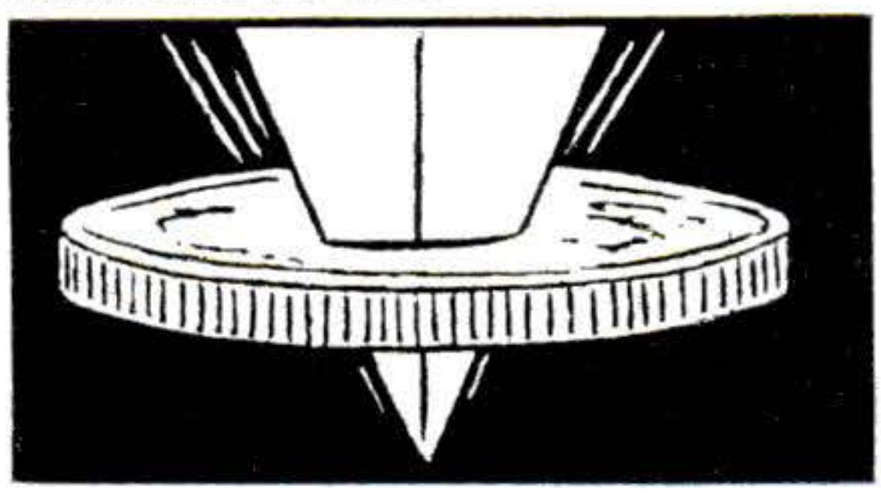

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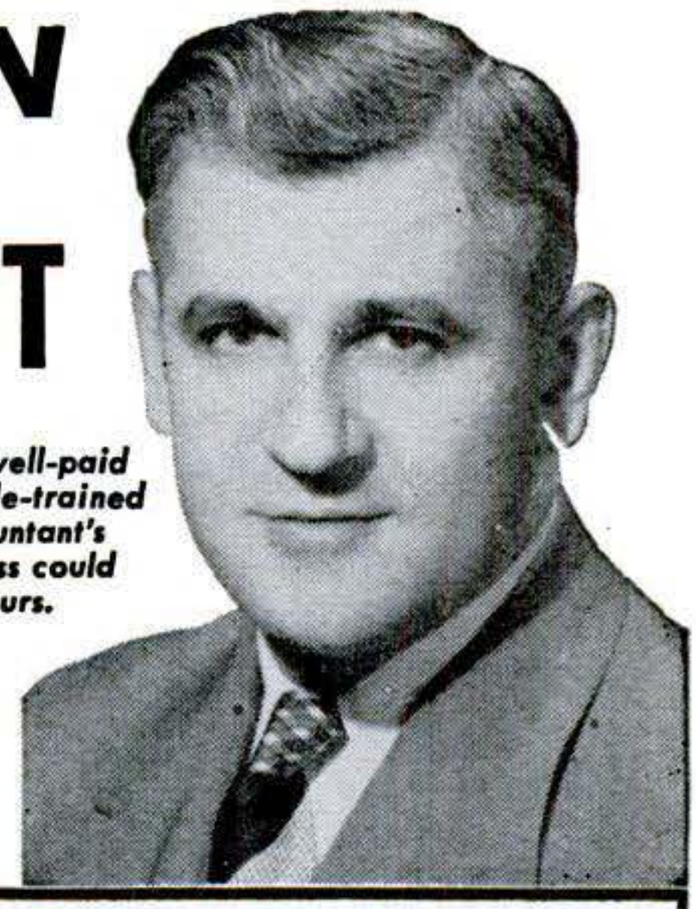

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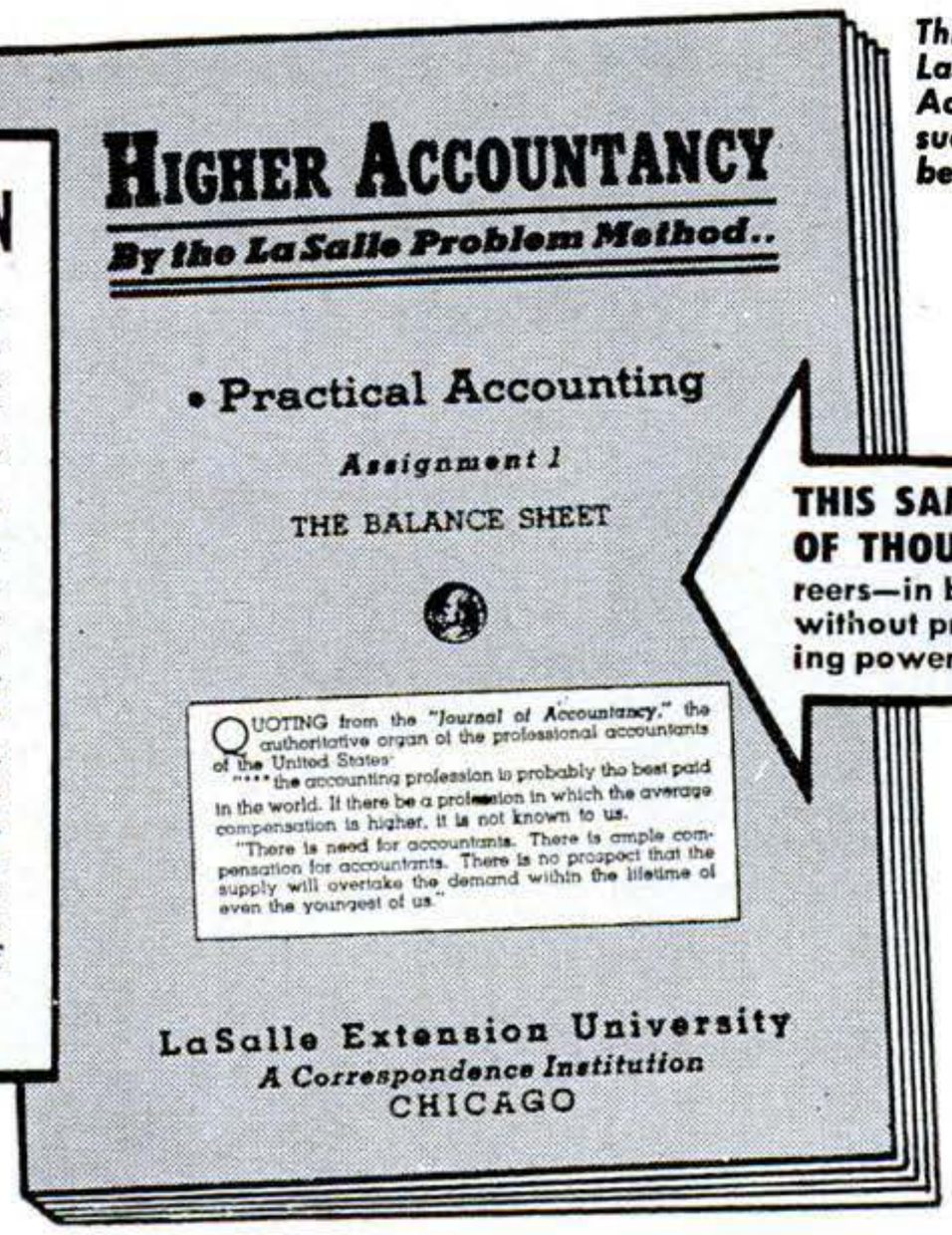

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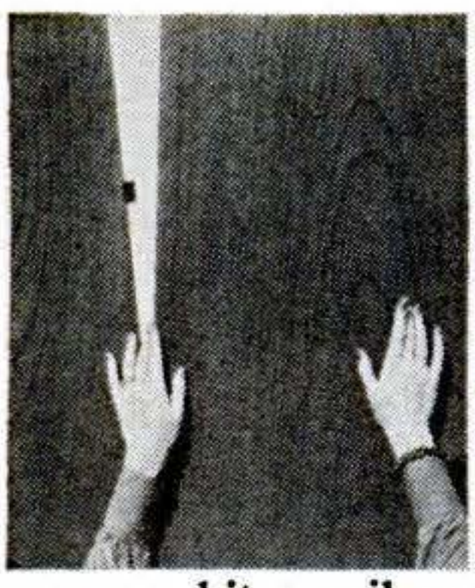

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Letters

Parakeet Problem: No Eggs

I read your article on parakeets [Oct. '53, p. 140] and just loved it.

I have a pair of 'keets and think there's nothing like them. However, I now have a problem. I'm trying to breed my pair. I put them together about two months ago. Two weeks after they were together, I hung the

nest box. The birds act loving enough—but no eggs.

The female won't let the male near the nest box. It's a cardboard box with an opening at the top with a perch just below, and on the bottom I have a concave wooden board. The female is forever going in and chewing the cardboard to little pieces. I noticed one day that she was piling them in the concave part only. I know they don't build nests, yet I can't understand her doing this.

MRS. PRESTON L. STOCUM, Selinsgrove, Pa.

Our staff expert on parakeets warns that you shouldn't pin too much hope on your bird's new passion for tearing up cardboard—some parakeets are just destructive. He suggests that you: (1) get a new nest box, preferably of wood; (2) get a new male.

Why Red, Blue and Green?

In your story on color TV in last November's issue [p. 120], why did you state that it would be best to have an electron gun for each of these three colors: red, blue and green? Why not, instead, for red, blue and yellow? Blue and yellow make green, so

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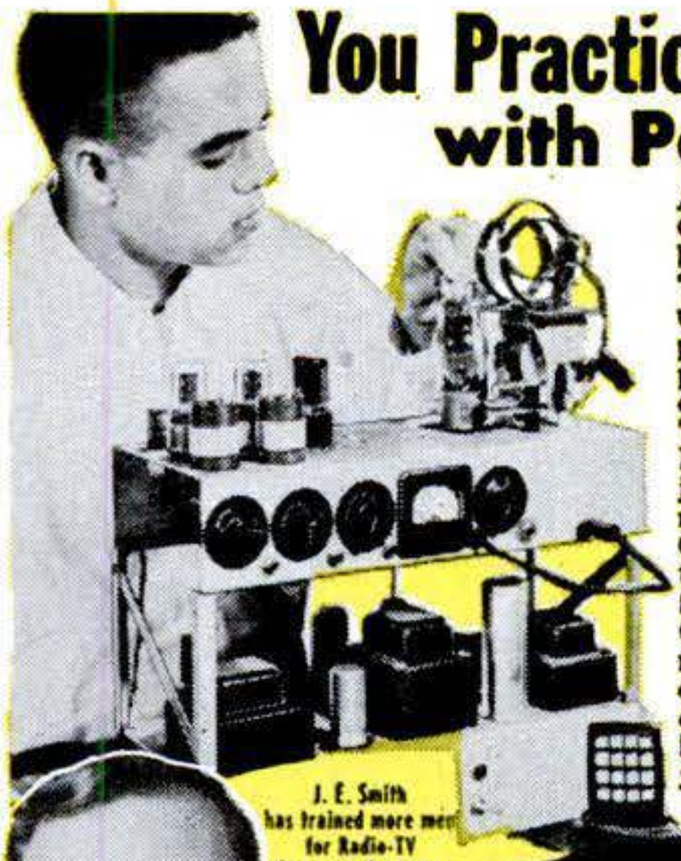

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As part of my Communications Course I send you kits of parts to build the low-power Broadcasting Transmitter shown at left. You use it to get practical experience putting this station "on the air," performing procedures demanded of broadcasting station operators. Training plus opportunity is the PERFECT COMBINATION for job security, good pay, advancement. An FCC Commercial Operator's License can be your ticket to a better job and a bright future and my Communications Course gives you the training you need to get your license. Mail coupon below and see in my book other valuable equipment you build. All equipment I send is yours to keep.

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Send for my FREE DOUBLE OFFER. Cut out and mail coupon below. Send in envelope or paste on postal. You will get actual Servicing Lesson to prove it's practical to learn at home. You'll also receive my 64-page Book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning, see photos of equipment you practice with at home. J. E. Smith, President, Dept. 4CB National Radio Institute, Washington 9, D. C.

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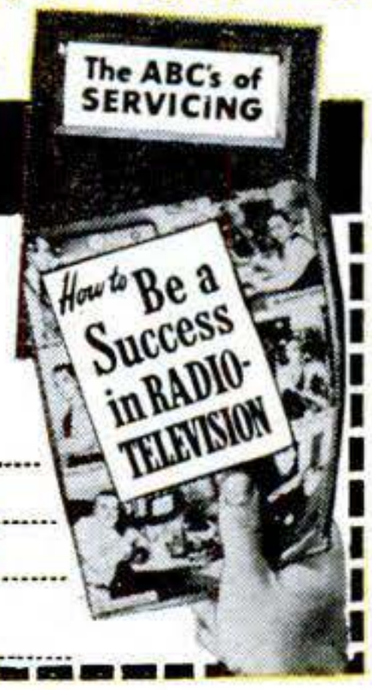

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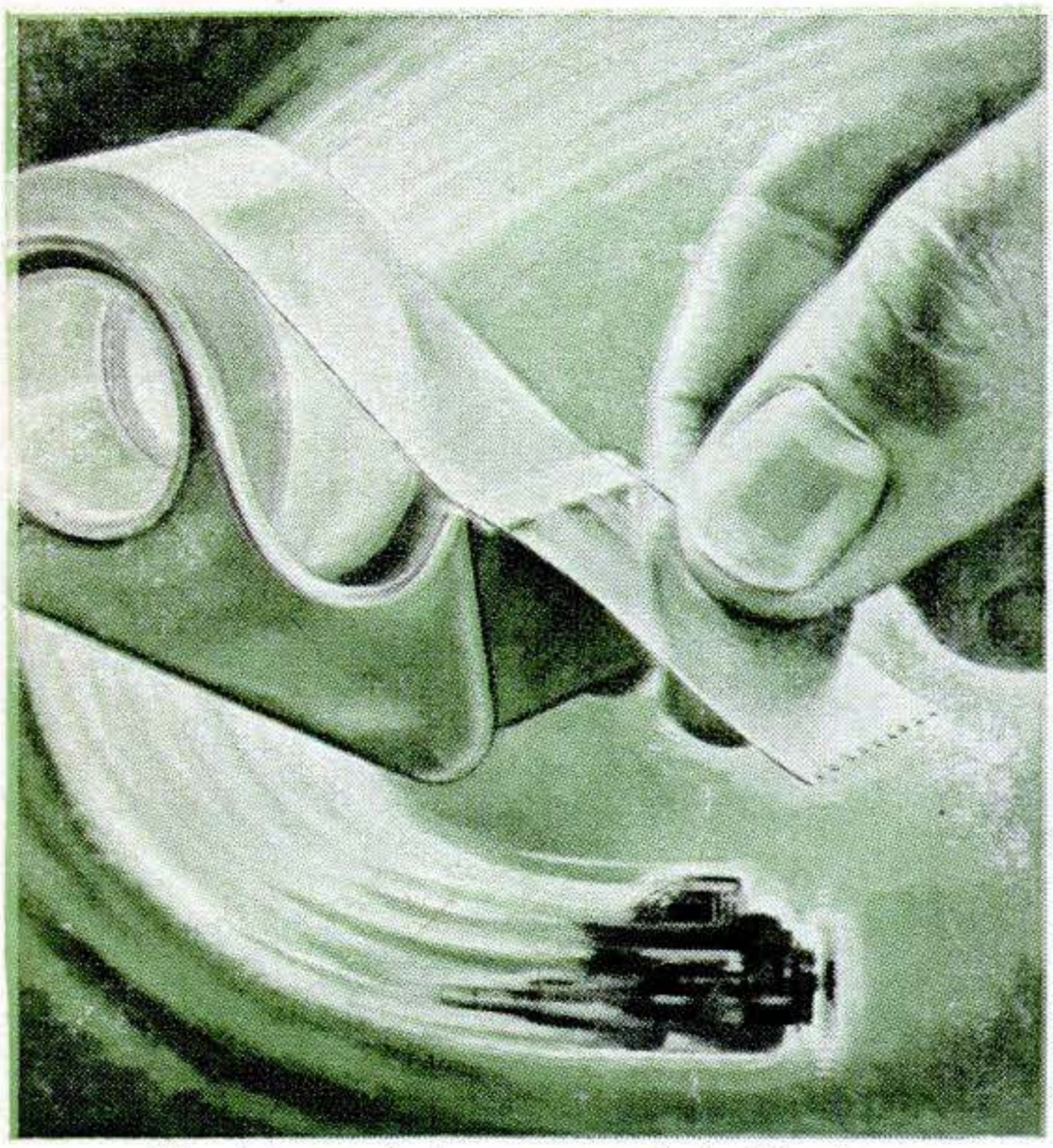

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you could have both green and a true yellow by using red, blue and yellow as primaries.

IRA FRANKEL, Pelham Manor, N. Y.

Color TV is basically different from painting, printing and color movies. Instead of using pigments to subtract certain colors from white light and reflect the remainder to the eye, it adds light of different colors together and directs the mixture to the eye.

In an additive system like this, the best primaries are red, blue and green. You can create most other colors by mixing light of these three in the proper proportions. You'd get yellow, for instance, by mixing green and red.

That Bewitching Twitch Again

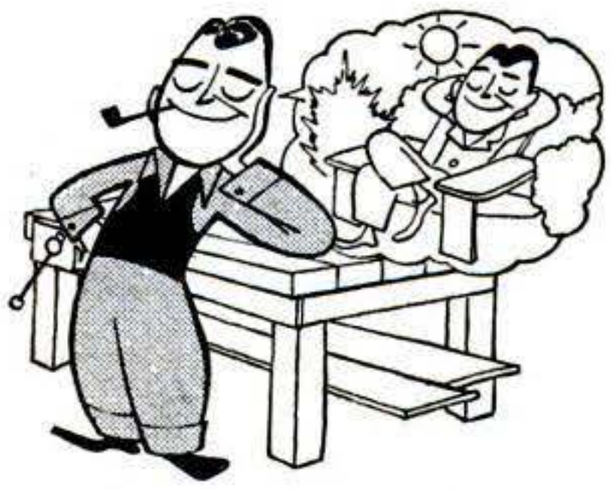
What happens in dowsing [Oct. '53, p. 99] is that the magnetic field of minerals or the electric field of running water affects the nervous systems of certain highly sensitive humans who possess the sensory gifts of migrating, homing and tracking animals. This results in spasmic nervous and muscular reflex actions to cause the divining rod to dip.

TED POWELL, Great Neck, N. Y.

Likes Beginning at the End

I agree with the readers who have declared that they prefer to page through magazines from back to front. I have a similar approach to projects in my shop.

I picture the finished project, then start



backwards until I am at the starting point of selecting the kind of lumber that I want to use.

DEAN R. MAYES, Pine Grove Mills, Pa.

Endorses Bible Story

I wish to compliment the editors for the excellent article by Herbert Yahraes in the December, 1953, issue [p. 86], "Infrared Rays Clarify Bible Texts."

Mr. Yahraes has done an accurate and attractive job of writing, and the editors by

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INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

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publishing the article have struck, I am sure, a new vein of popular interest.

REV. ELDON W. KOCH, College Park, Md.

That Cadillac on the Cover

Since when has Cadillac, or any other American automobile company, for that matter, been producing an automobile with a right-hand drive in recent years? Better take a look at the Caddy on the cover of your February issue.

FREDERICK M. DENNY, Milford, Conn.

Our cover artist insists that he intended that Cadillac for export to England, where all cars wear the steering wheel on the right.

No Tip-Off for Burglars

In your November issue [p. 161], Carl Ayars said he would like to see them make a ratchet device to drown the sound of falling safe-combination tumblers.

Unless Mr. Ayars has a very old-style safe, he need not worry about a burglar hearing any sound from operating the combination which will tell him how to set the dial to unlock the safe.

Modern safes have from three to five or six rings or disks, in each of which a slot is cut. To unlock the safe, all of these slots must be in line in a certain position in rela-

tion to a lever or to a bar which falls into the slot or slides into it, as the case may be. Neither lever nor bar comes into contact with the disks while the combination is being operated and therefore there is no sound to indicate the position of the slots.

The sound heard when turning the combination is the striking together of the lugs or pins in the disks which cause them to turn to the unlock position. The burglar cannot possibly tell what the relation of the pins is to the slots, so cannot open the safe by "hearing the tumblers fall." Old-style safes have a lever which rides the

only RALEIGH has it!

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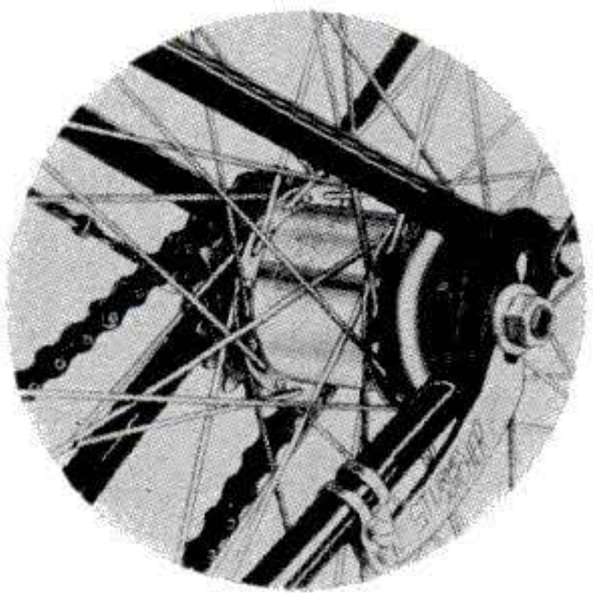

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The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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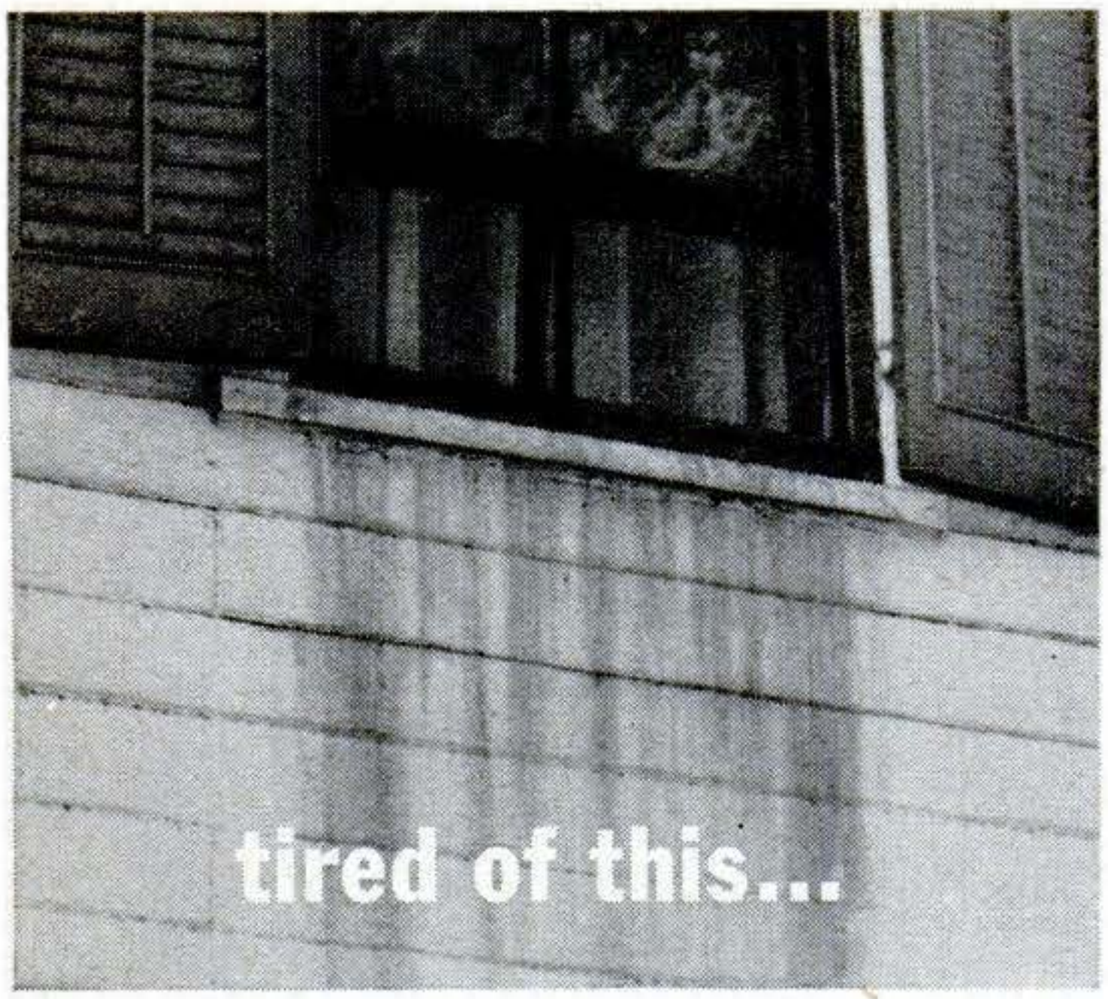

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C. L. BOSSMEYER, Rockford, Ill.

Would Limit Cars to 70 M.P.H.

Instead of building superhighways and blaming the teen-agers for the many accidents, blame the car manufacturers. A better-constructed body with less horsepower would save a lot of lives.

The extra oomph that Wilbur Shaw tells about getting him out of a tight spot [Nov. '53, p. 99] is okay for a driver of his experience, but I imagine a lot of times that extra oomph will make a less experienced driver try to pass and get into trouble.

JOE H. KLEIN, Lancaster, Wis.

A Hut That Sprang from Print

I enclose a photograph of handiwork of mine that resulted from reading Jerry Parker's article on "How I Built the Hut" [June '53, p. 178].

My version, variously known as the Wigwam or the Doghouse, used salvaged 10-foot crossarms for framing floor and roof sections, resulting in a floor space of approximately 100 square feet.

The front section, featuring a Dutch door, is covered with green asphalt shingles, while the roof is aluminum siding, painted with green metal paint. The whole structure is leveled on concrete blocks. At present the hut is used for storage. But it's a fair bet it will wind up in the summer as an overflow sleeping cottage.

J. E. MCKINNEY, West Hill, Ont.

Helicopter Blows Out Fires

Last August, you published a letter [p. 8] from Robert J. Mills of Valley Stream, N. Y., suggesting helicopter fire engines.

A friend of mine, flying a training heli-

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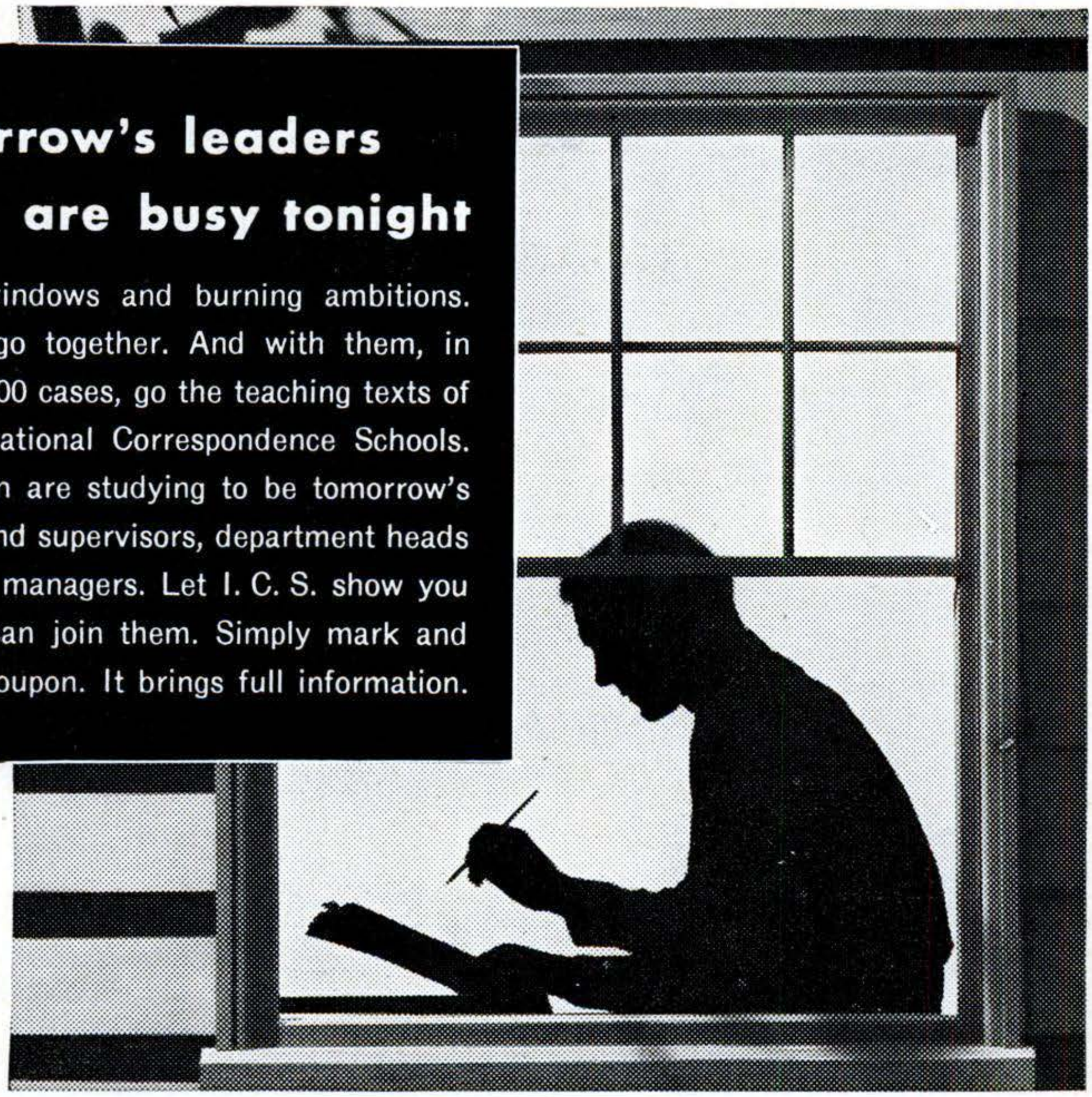

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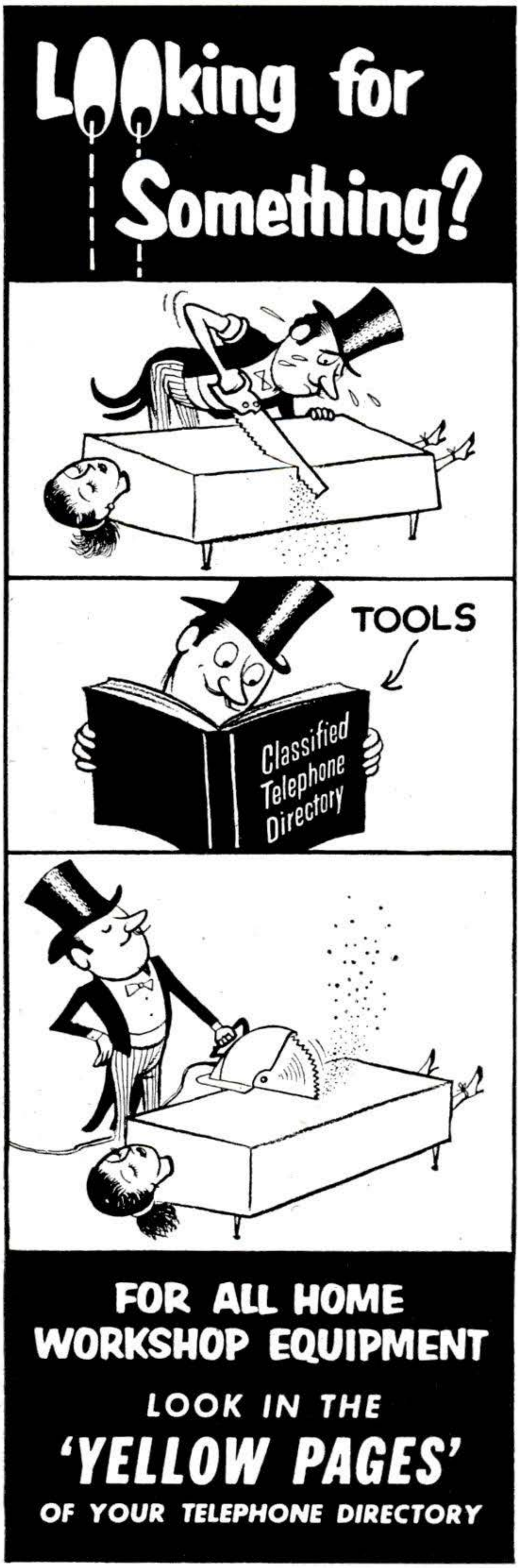

copter, actually used his craft for this purpose—in an unusual way. From the air he spotted a landing accident on a field. The crashed plane began to burn. My friend flew over it and hovered there, blowing out the fire with the down-wash of his rotors.

The C.O. found out about it and tried the same thing on a junk airplane that had been deliberately set afire. The helicopter again blew out the blaze. On the third try, however, the tank on the junker blew up, nearly clobbering the hovering helicopter. That ended the experiment.

Seriously, though, I believe that helicopters will eventually take over from surface vehicles for fighting fires and for ambulance and police work.

Less seriously—that down-wash also spins a pheasant in nicely or drives a cornfield quicker than a good dog.

ORVILLE LIPPERT
Reserve Helicopter Sqdn. 731
Grosse Ile, Mich.

Settling an Atomic Dispute

I think you made a mistake in printing the statement that "there are only 90-odd atoms" [Jan., p. 173]. I say there are approximately 1,080. As proof of this statement, I refer you to General Electric's Chart of the Nuclides, revised November, 1952.

FRANK GIACOBBI, Trenton, N.J.

By "atoms" we meant basically different kinds of atoms—chemical elements—and there are 90-odd of these, indicated by the 90-odd different atomic numbers identifying the elements. If you count all the subdivisions of the elements into isotopes, as the GE chart did, you will, of course, get a much higher figure.

Cobb Got a Push from the Wind

You stated in your December issue [p. 12] that John R. Cobb set the world's absolute speed record for automobiles by traveling 394.196 m.p.h. I read in the *Encyclopedia of Sports* that Cobb was the first man to go over 400 m.p.h. in an automobile. Is this right?

EUGENE NIERODA, Brooklyn, N.Y.

Both statements are correct. Cobb established his record by averaging out his speeds in one run against the wind and one run with the wind. On the run with *the wind, he did go more than 400 m.p.h.*

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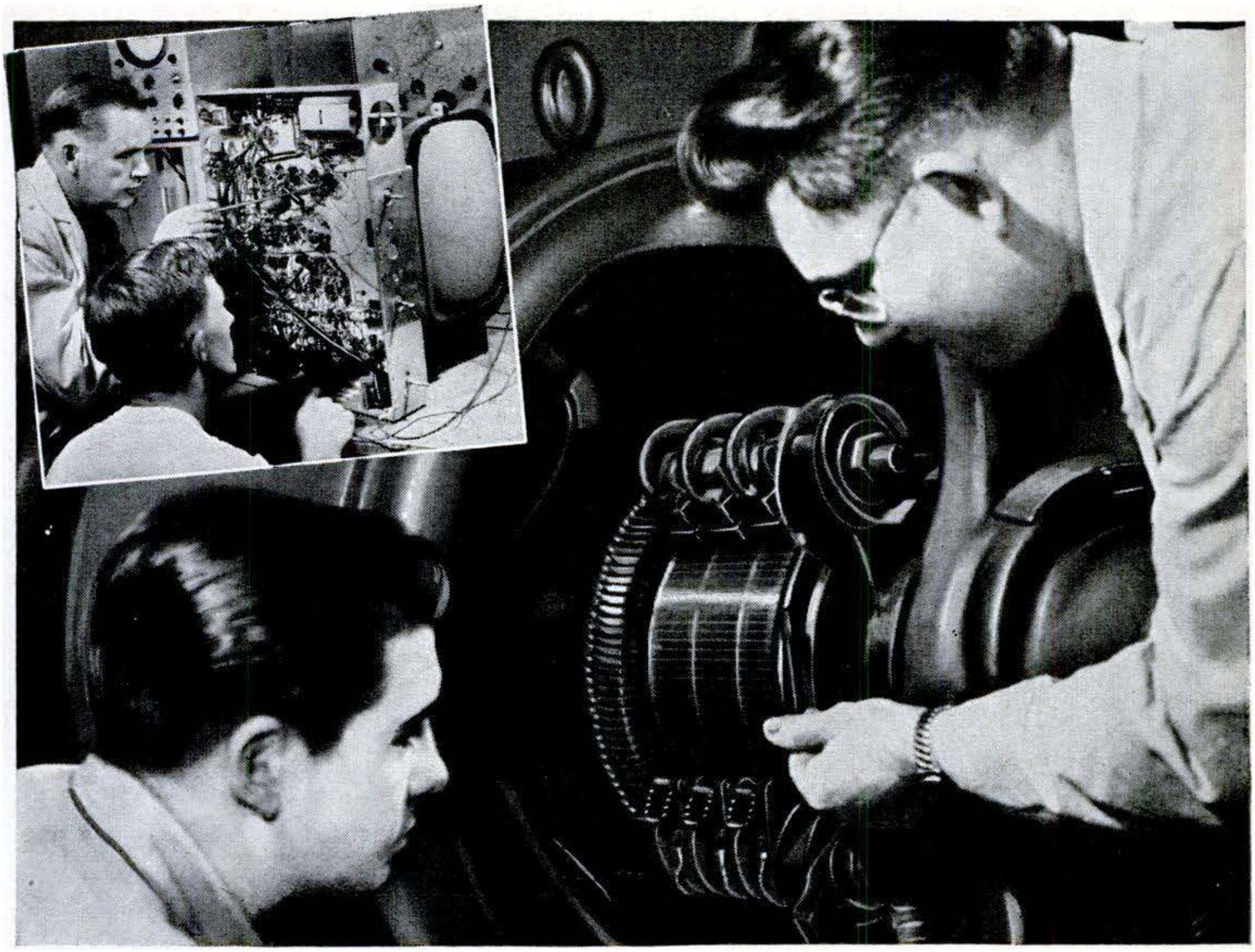

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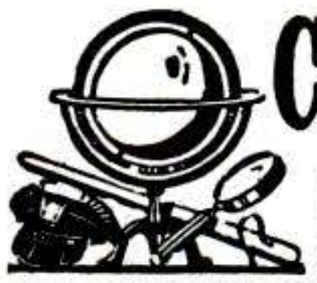

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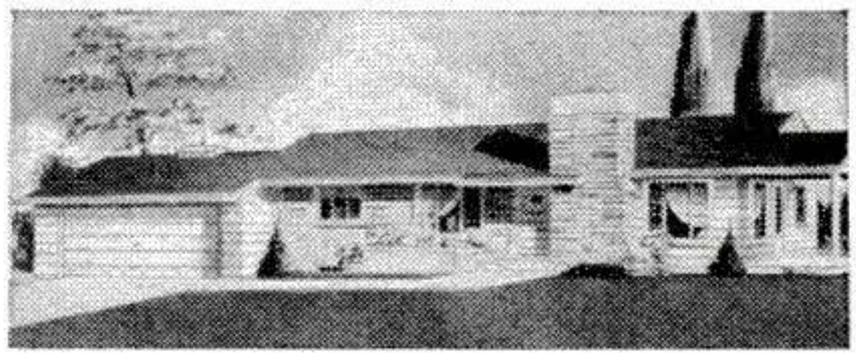

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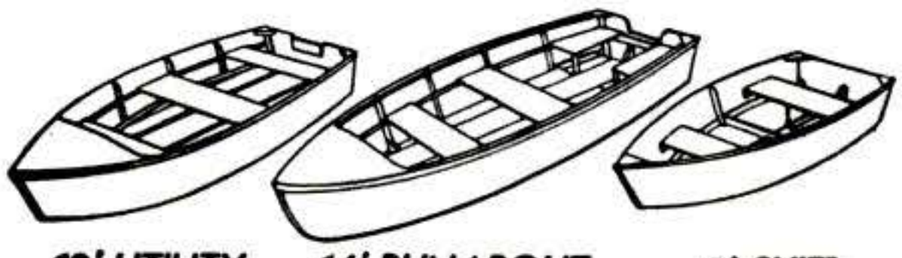

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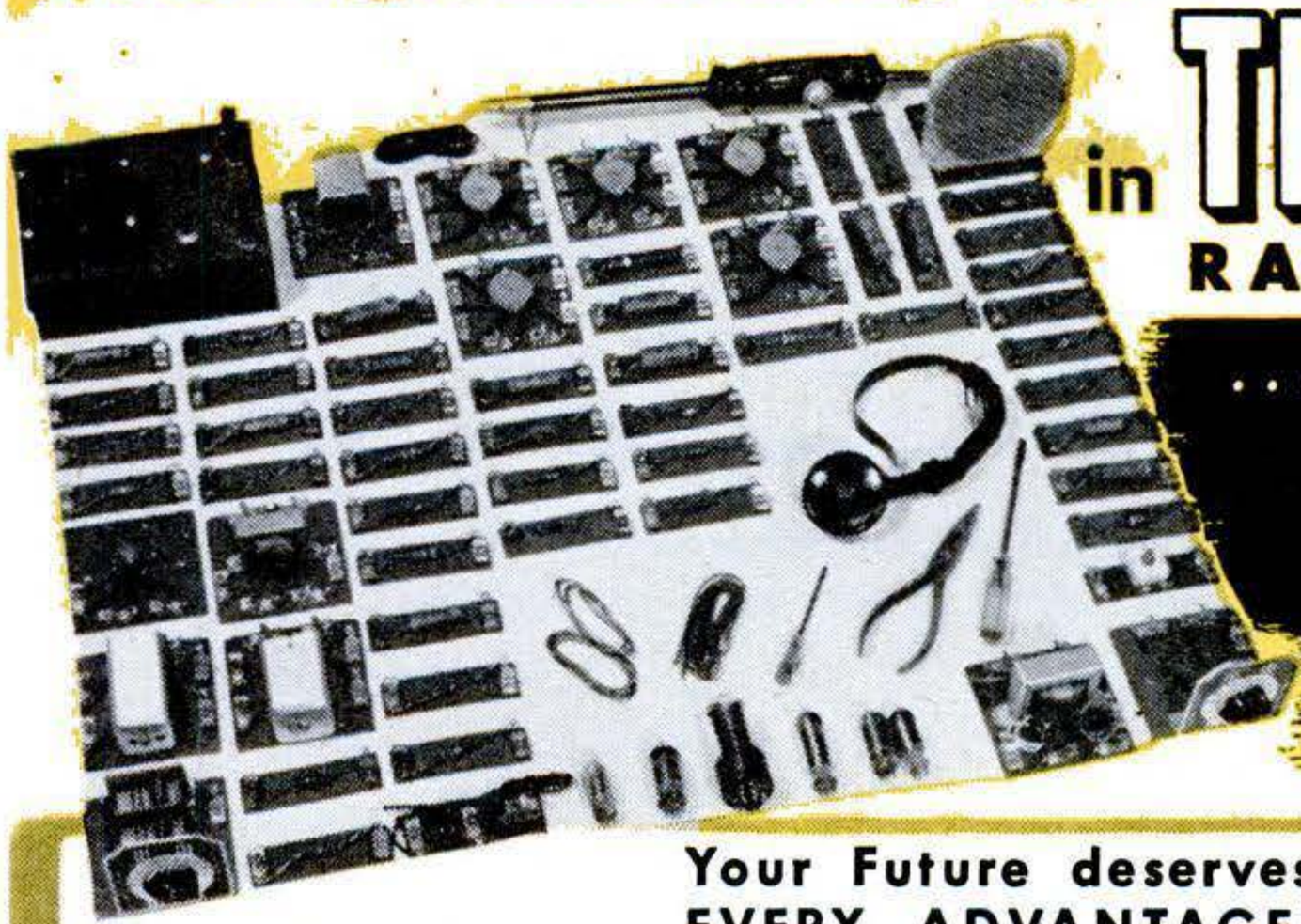

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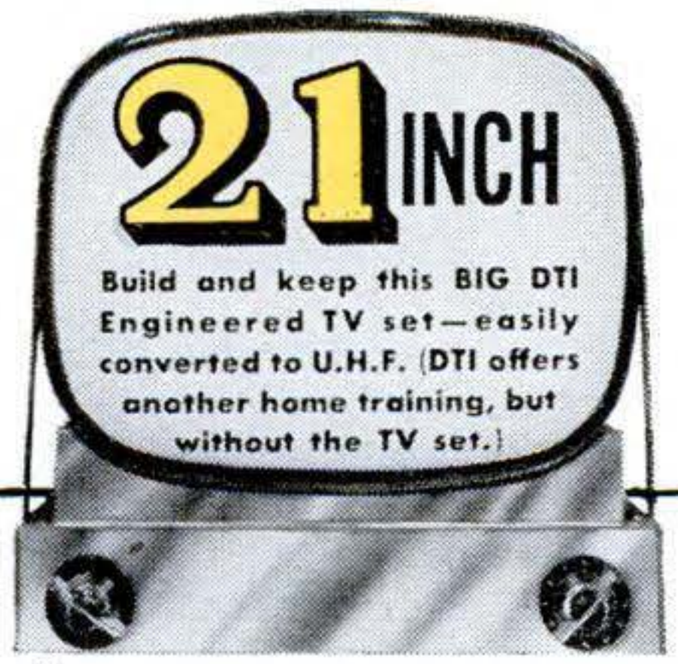

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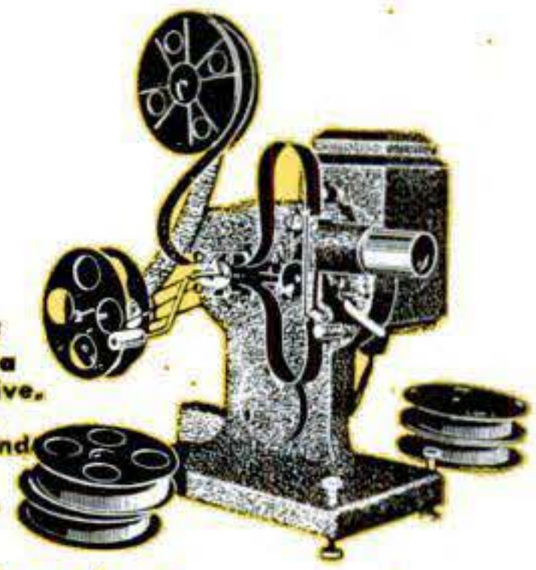

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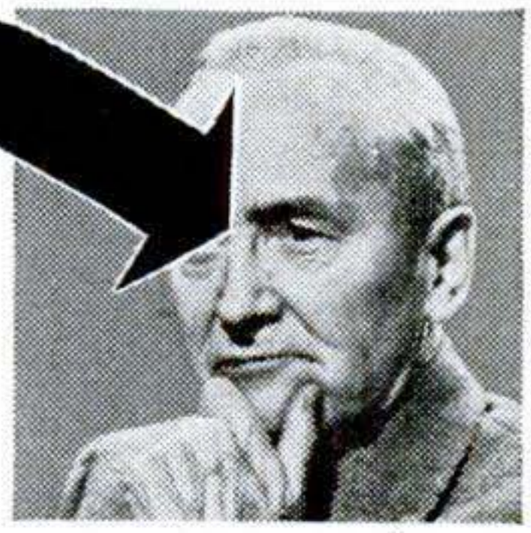

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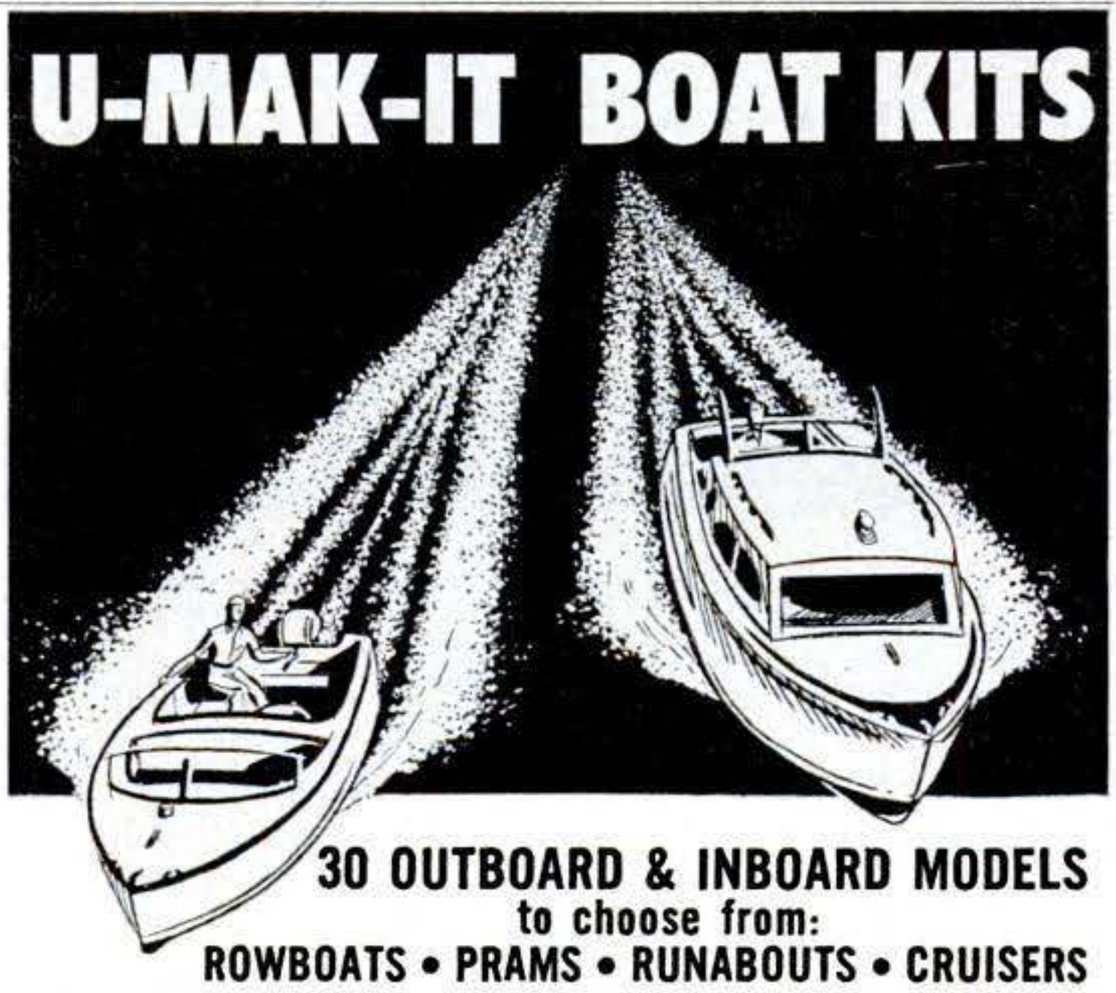

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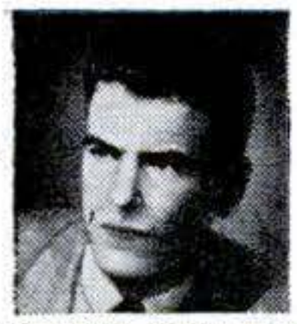

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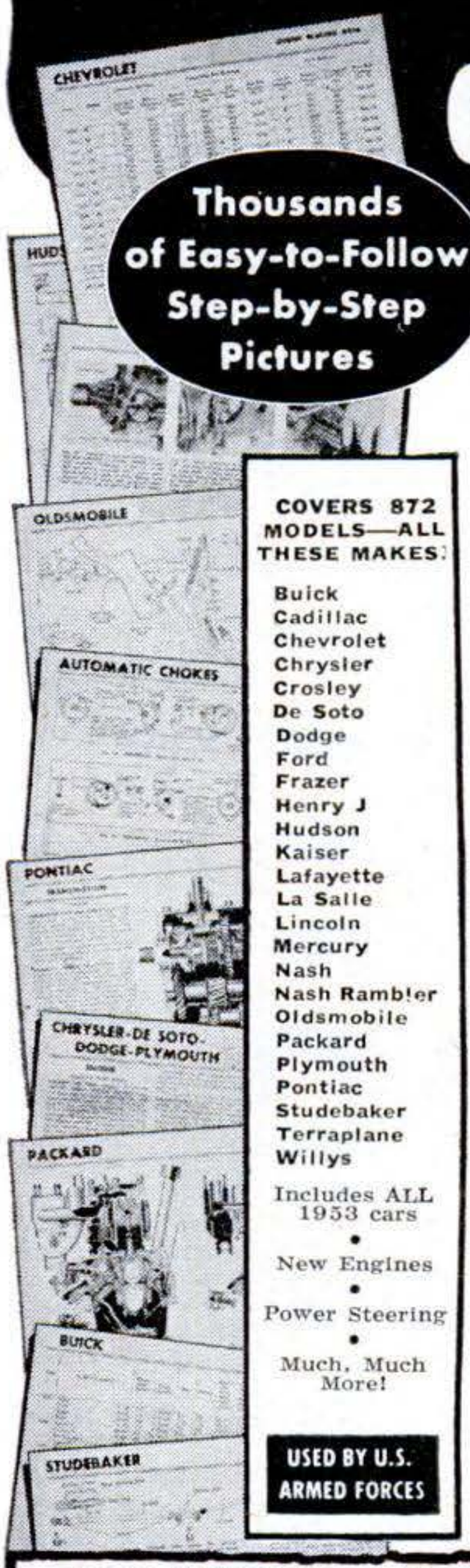

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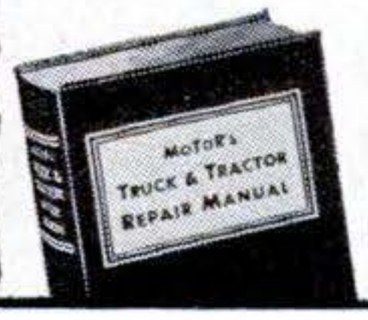

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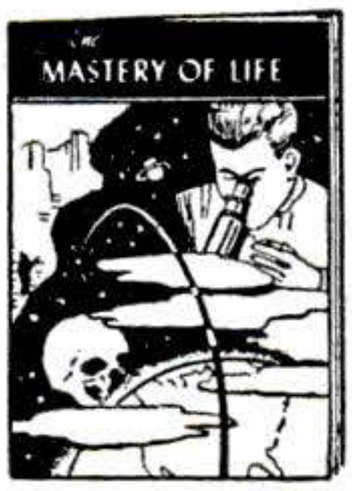

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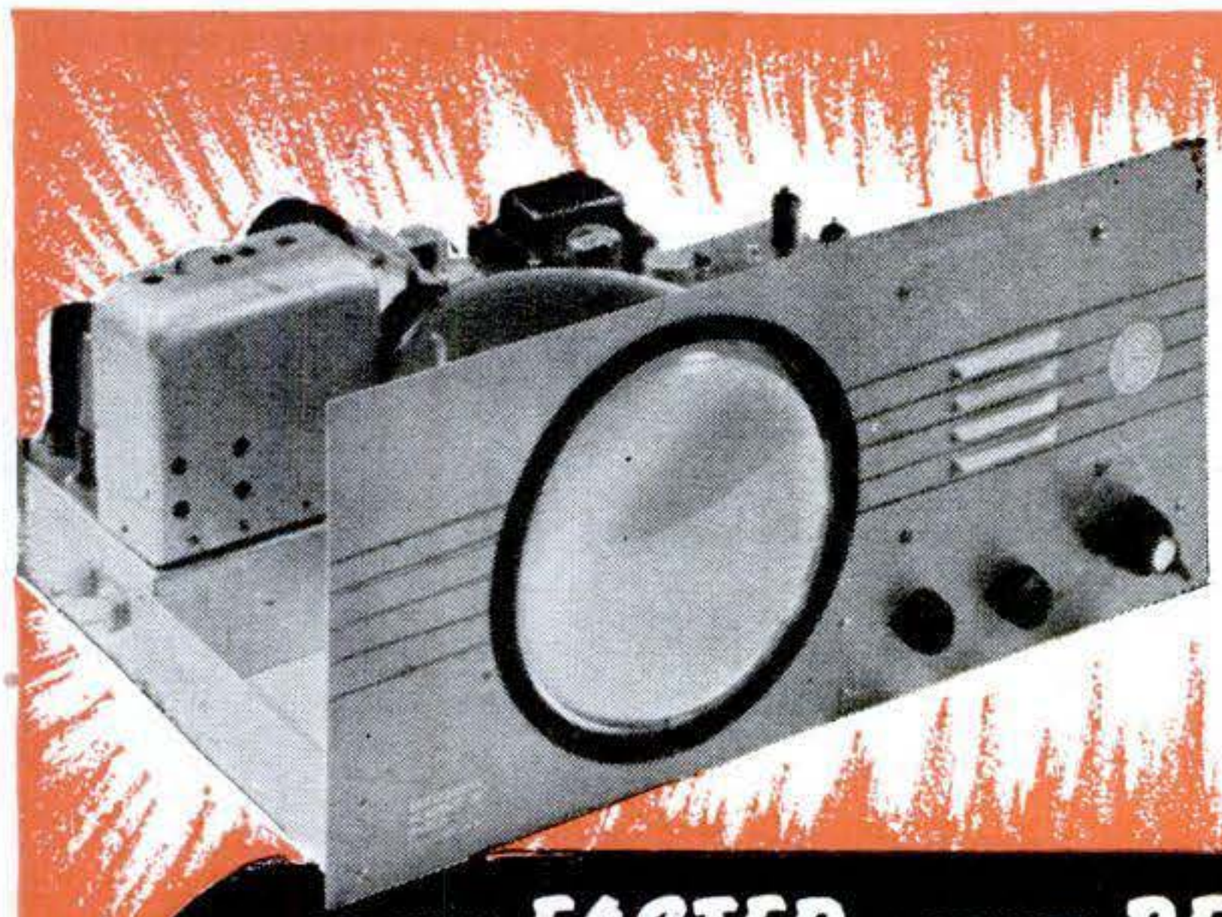

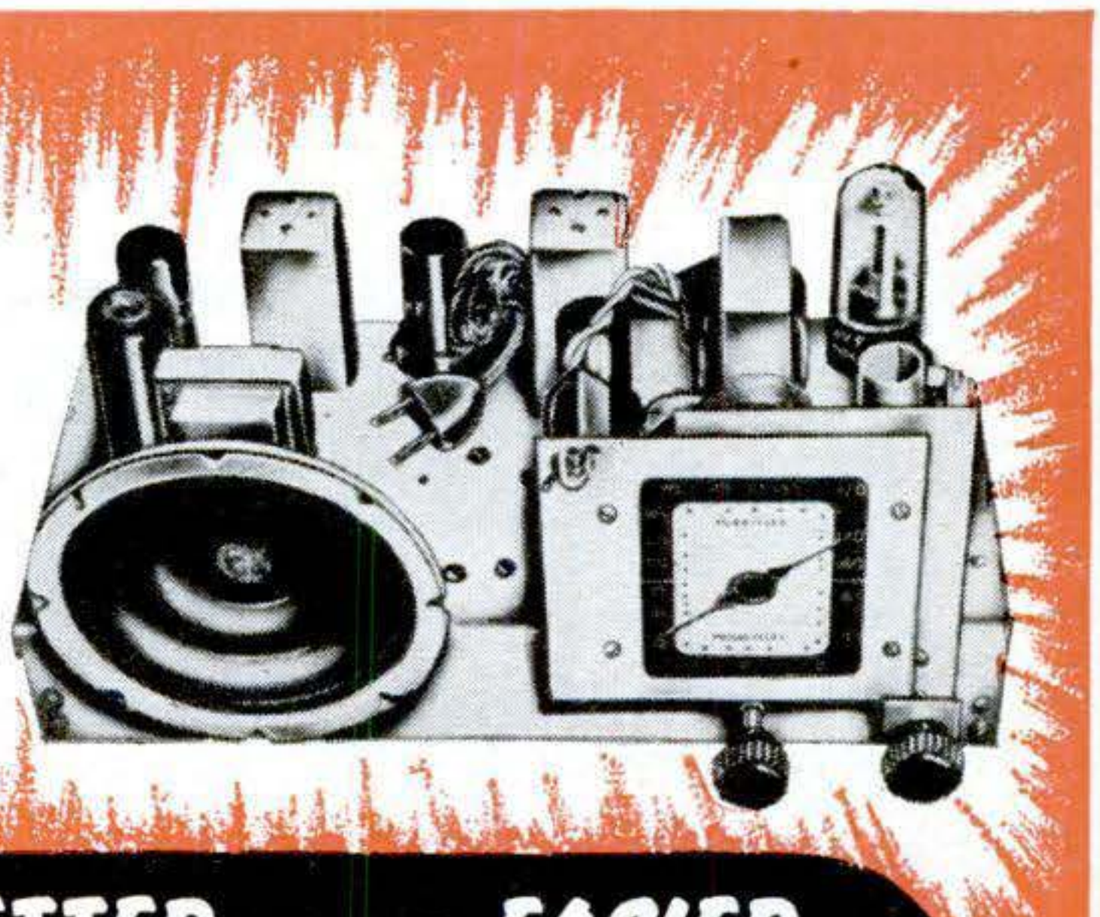

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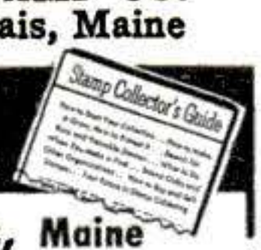

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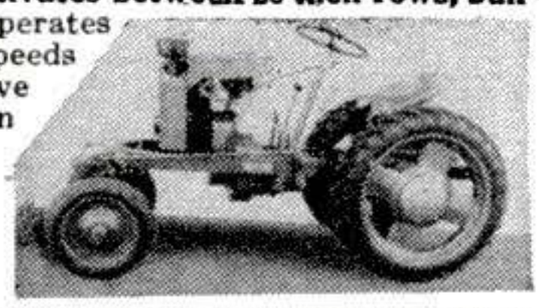

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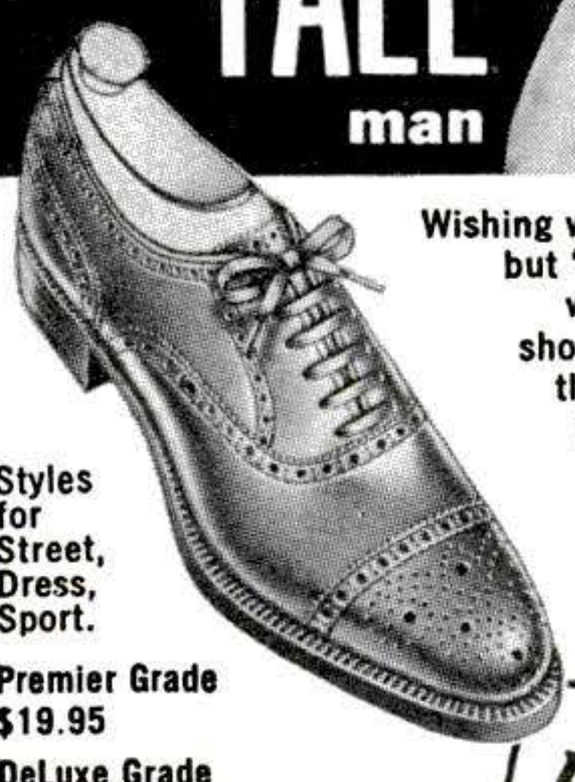

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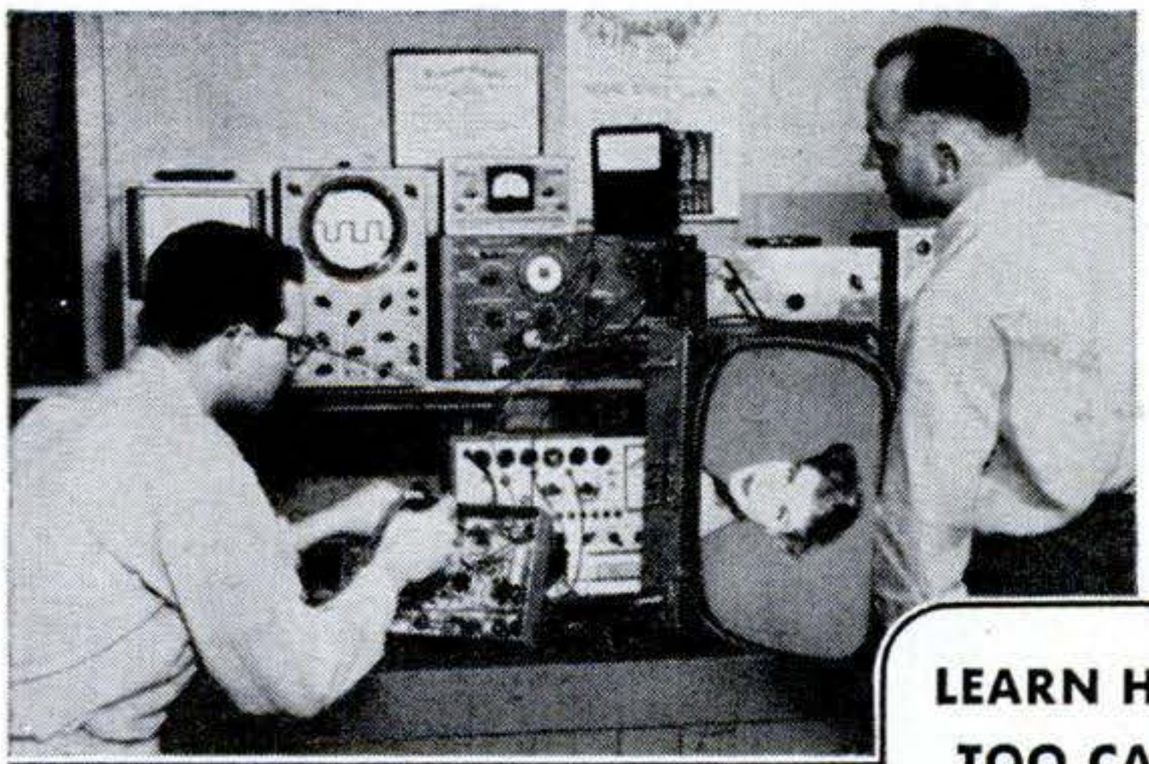

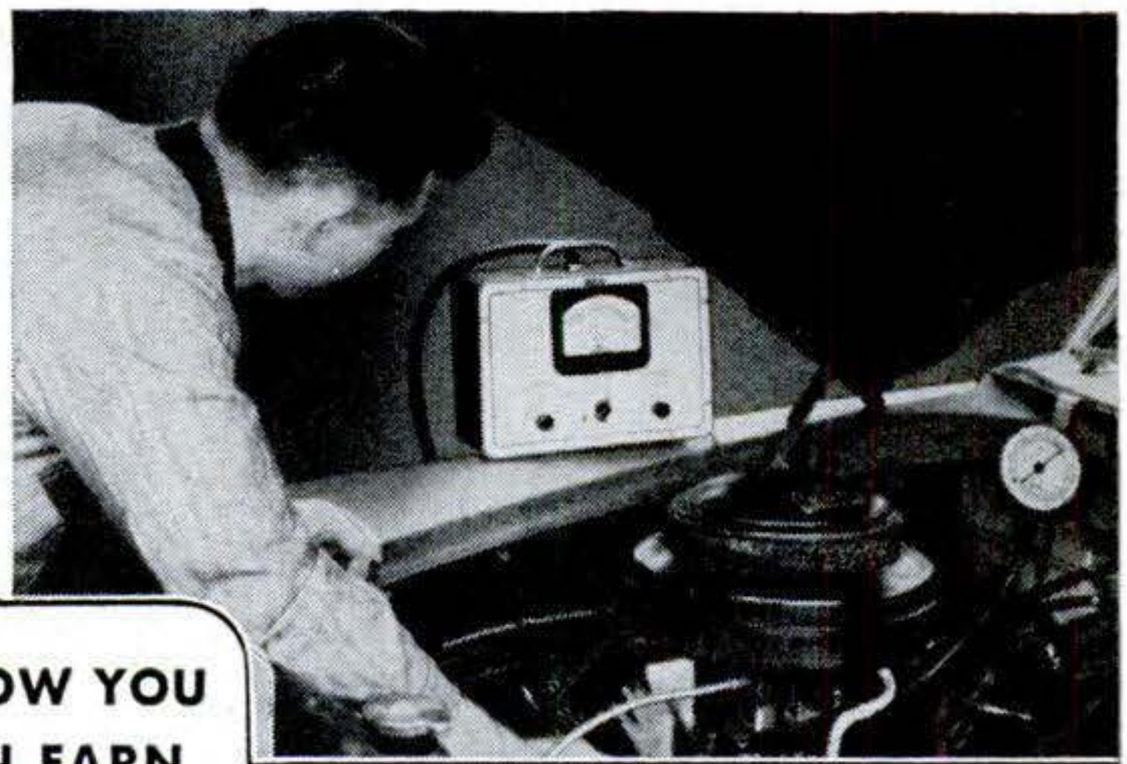

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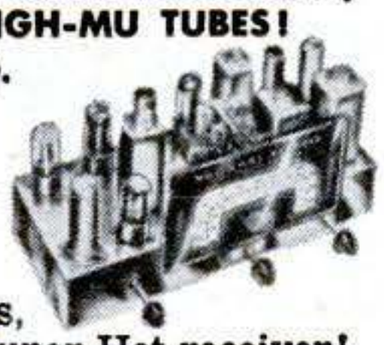

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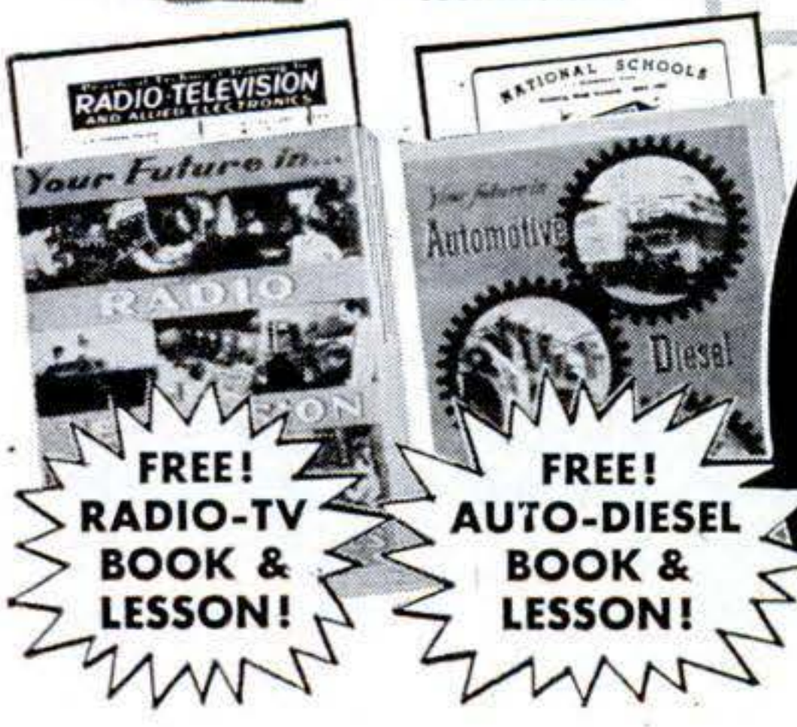

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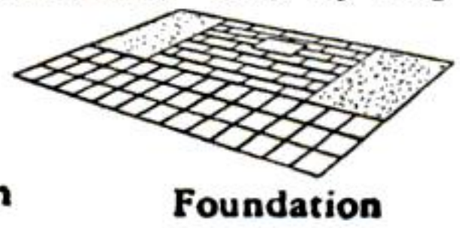

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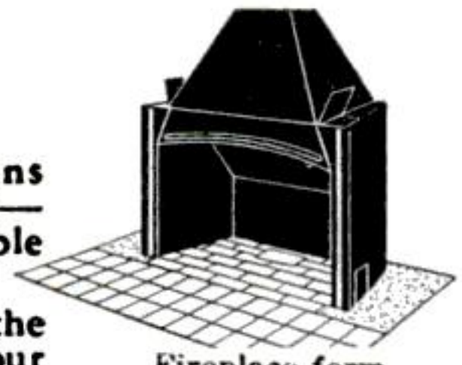
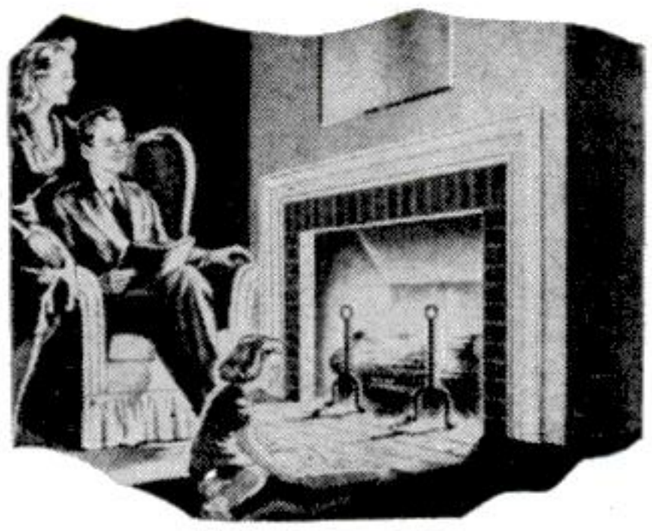


Fireplace form set on foundation includes firebox, damper, down draft shelf and smoke dome.



Brick, stone or cement block can be used around the form.

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640x15	5.68	750x16(6)	8.98	650x20	10.88	1000x20	19.98
650x16	5.78	800x15	6.88	700x20	12.88	1000x22	21.98
650x16(6)	6.98	820x15	7.48	32x6(8)	10.48	1100x20	20.98
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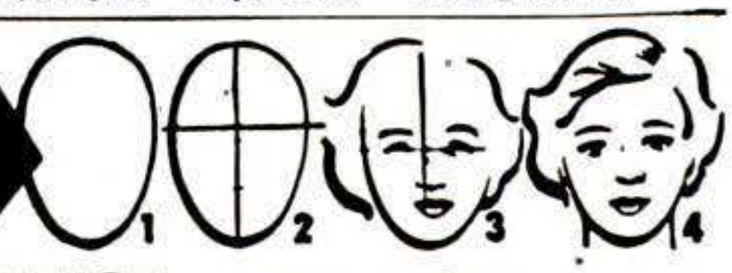

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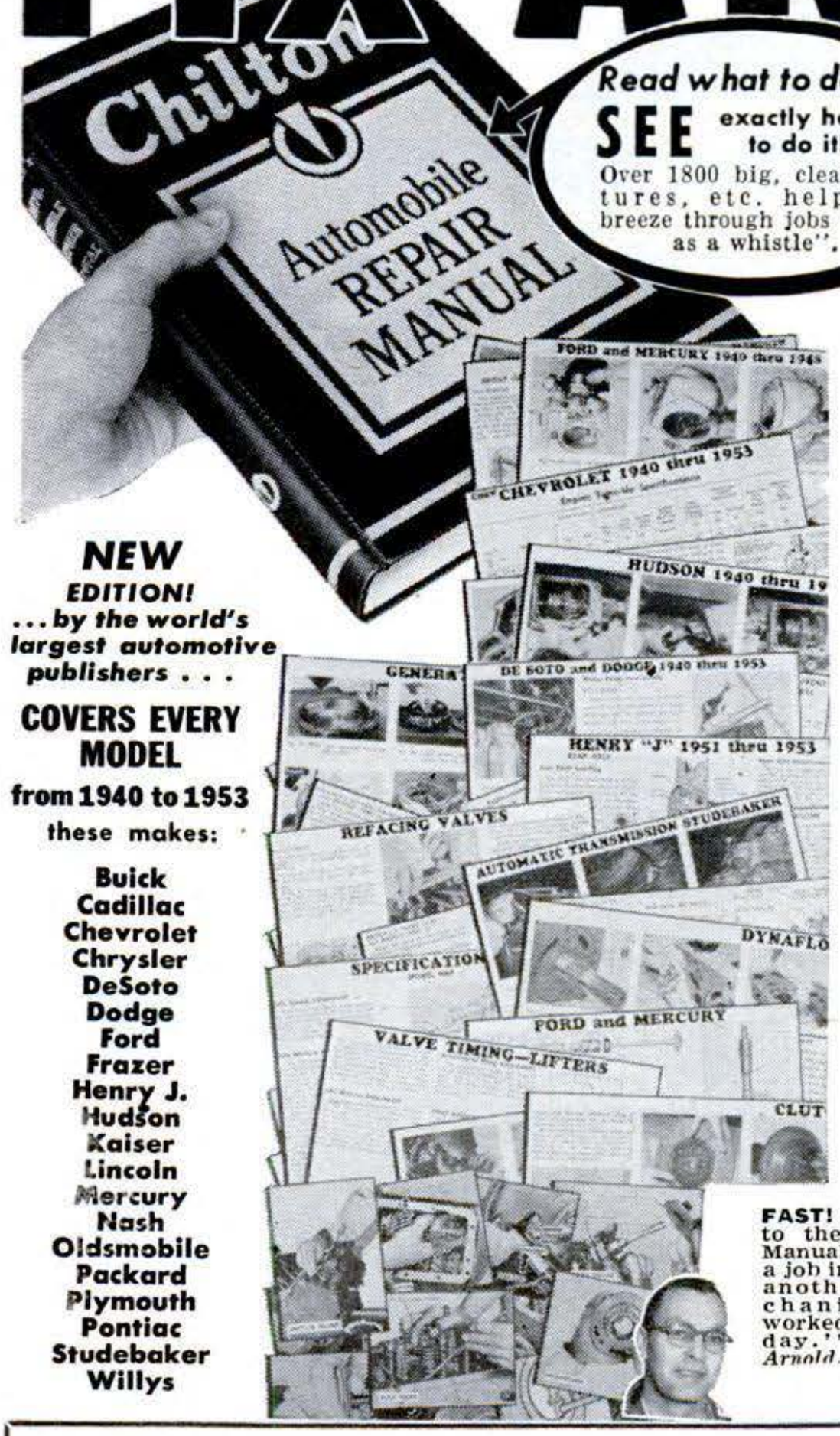

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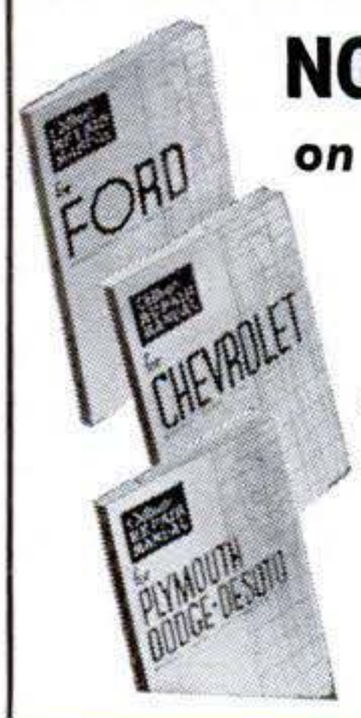

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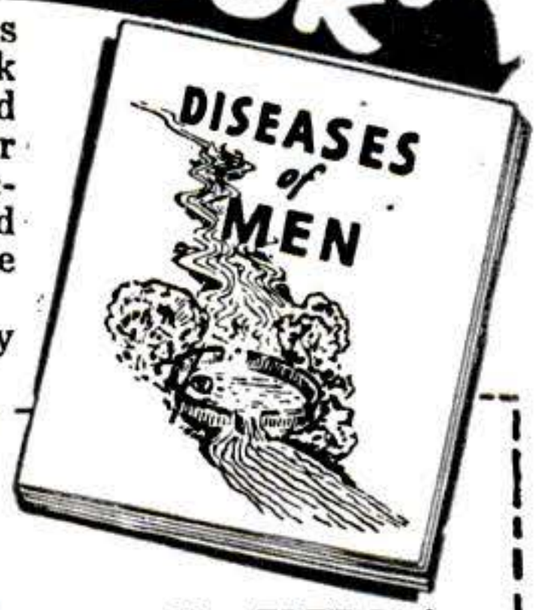

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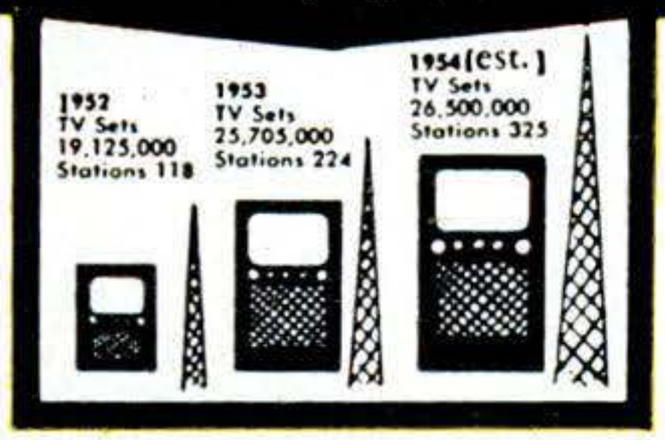

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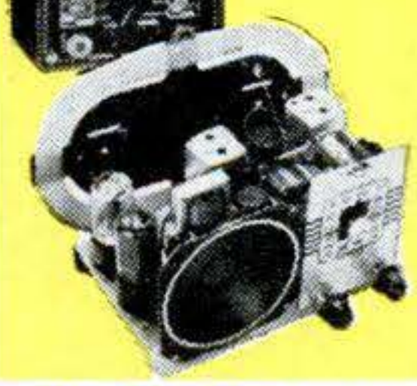

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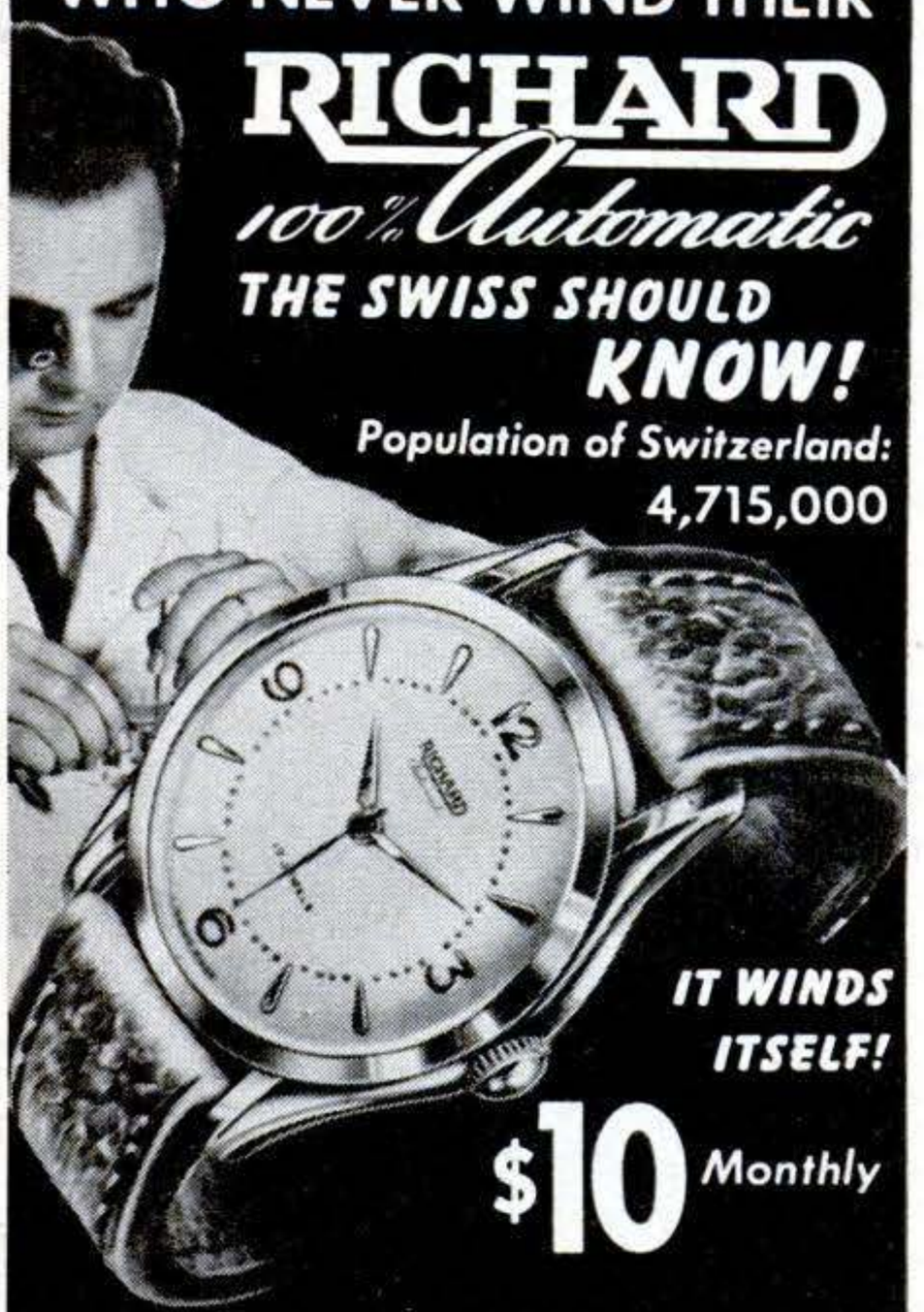

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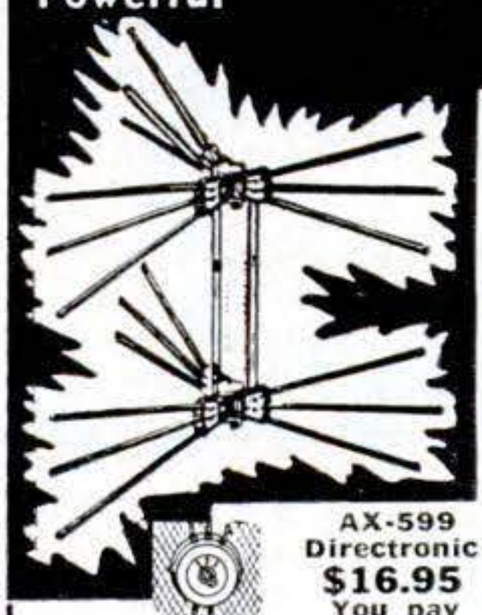

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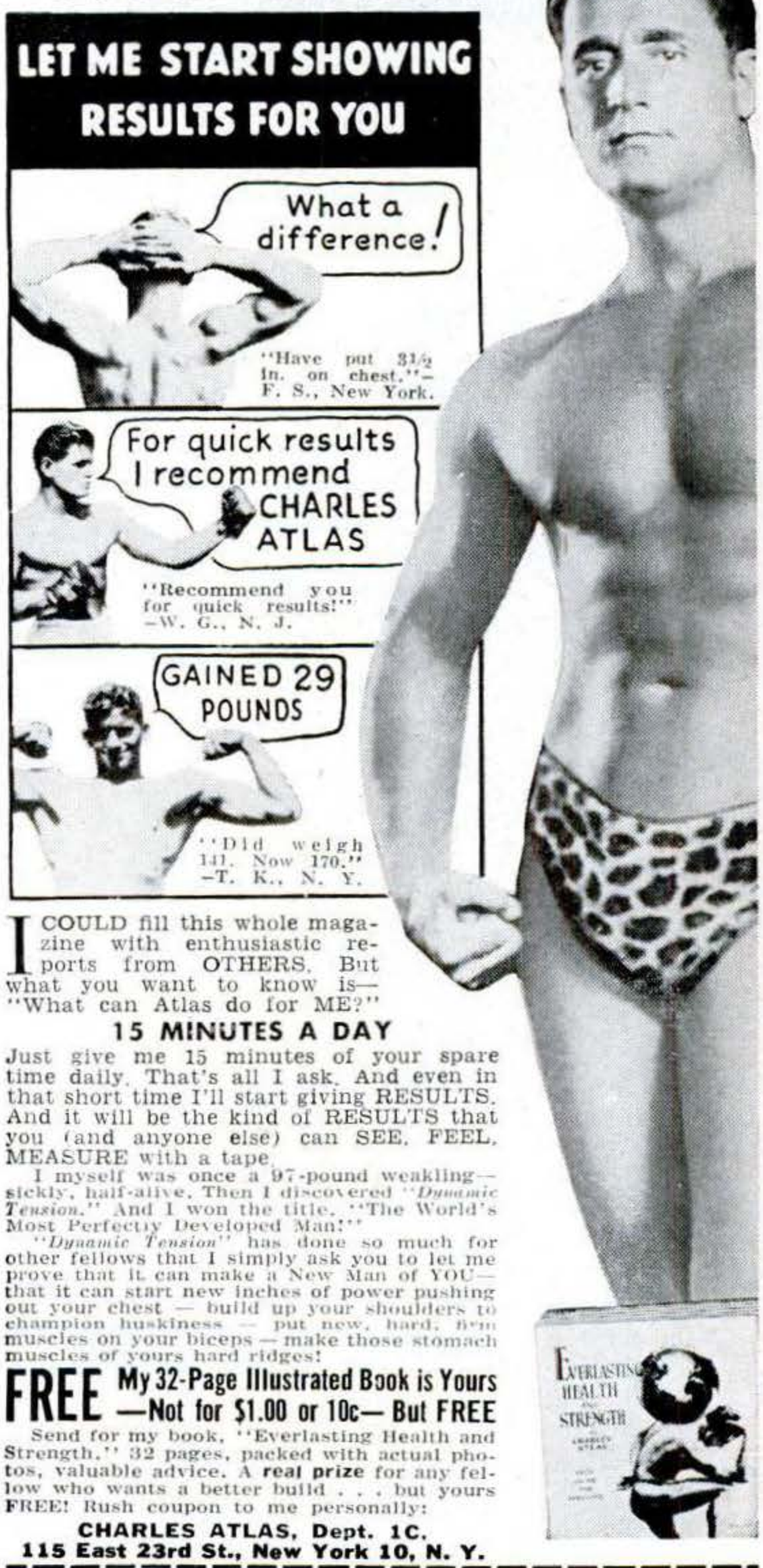

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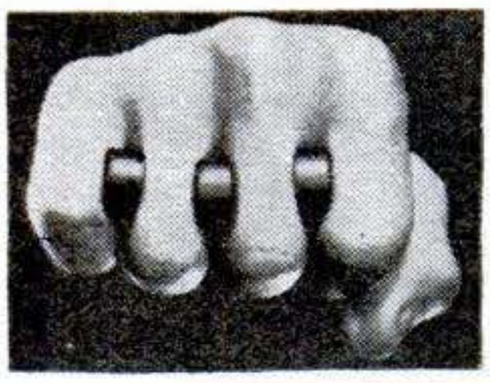

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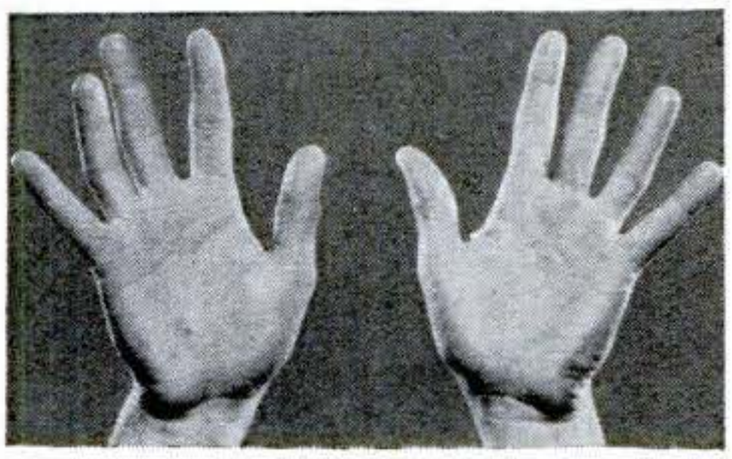

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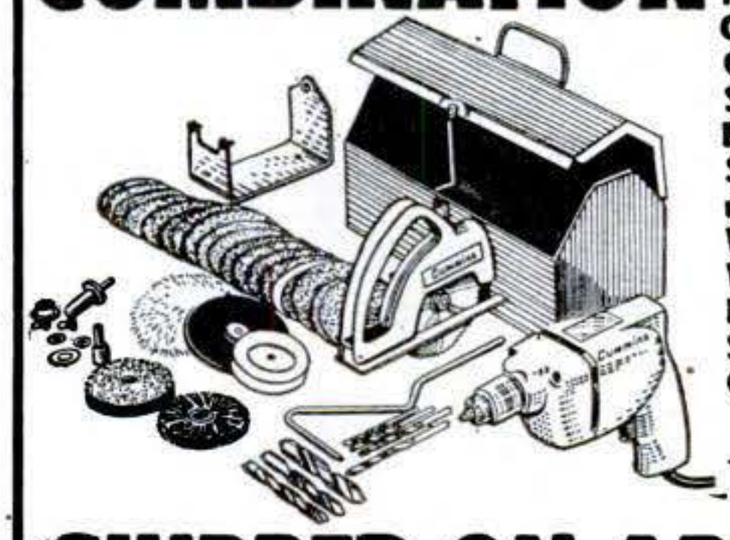

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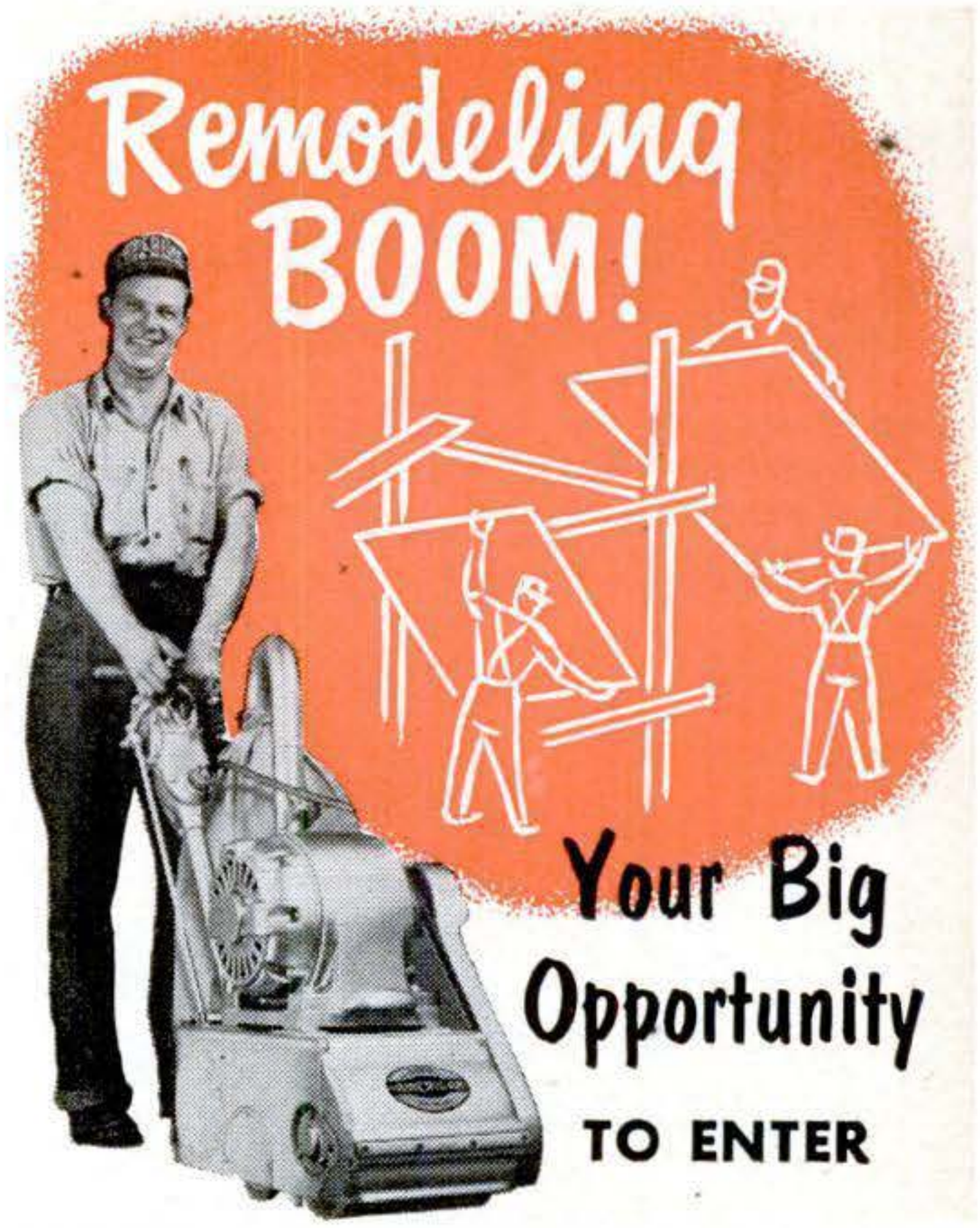

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650-16(6)	7.15	710-15	5.35	750-17	10.85	825-20	17.75
700-16	6.25	760-15	5.85	750-15	10.85	900-20	17.85
750-16(6)	8.35	800-15	6.25	825-15	11.05	1000-20	16.85
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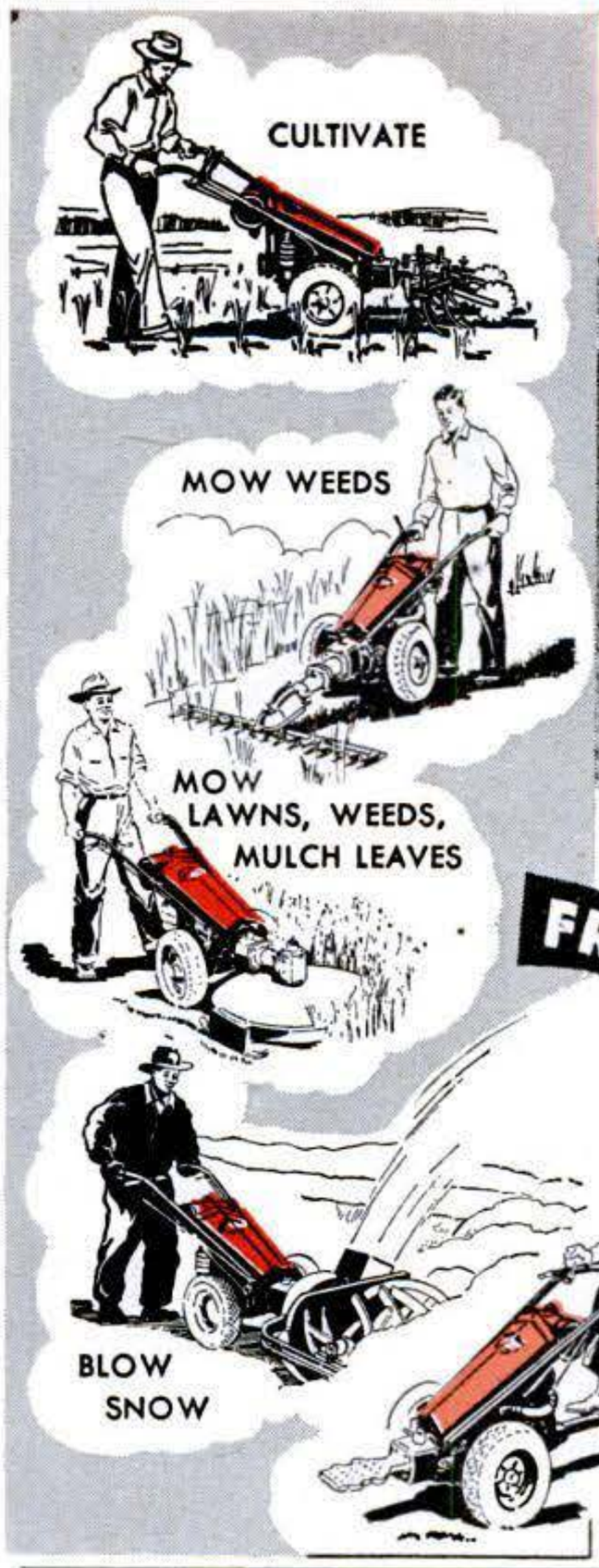

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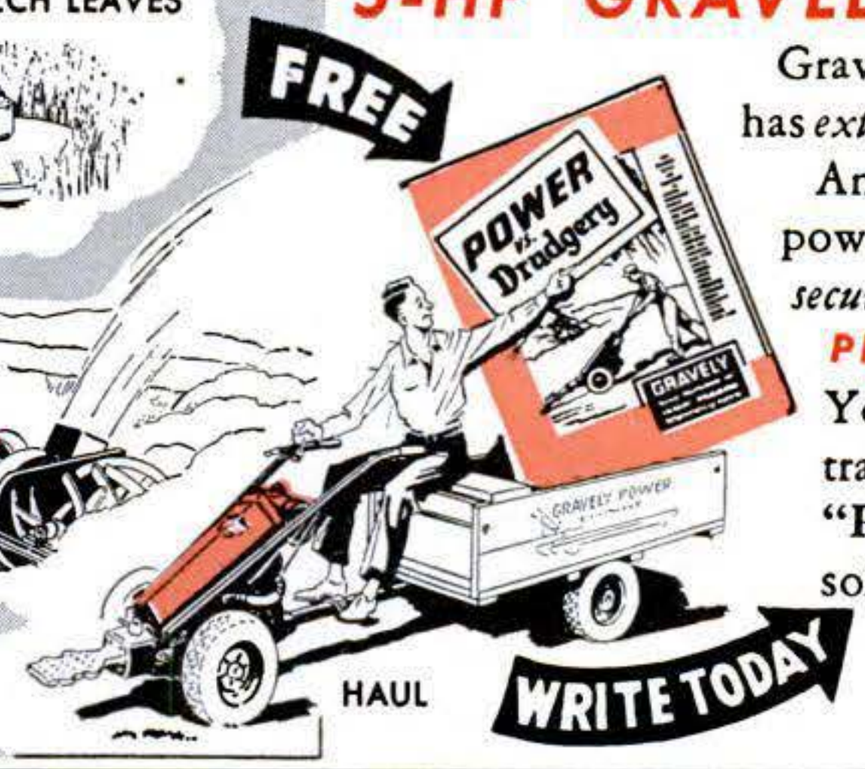

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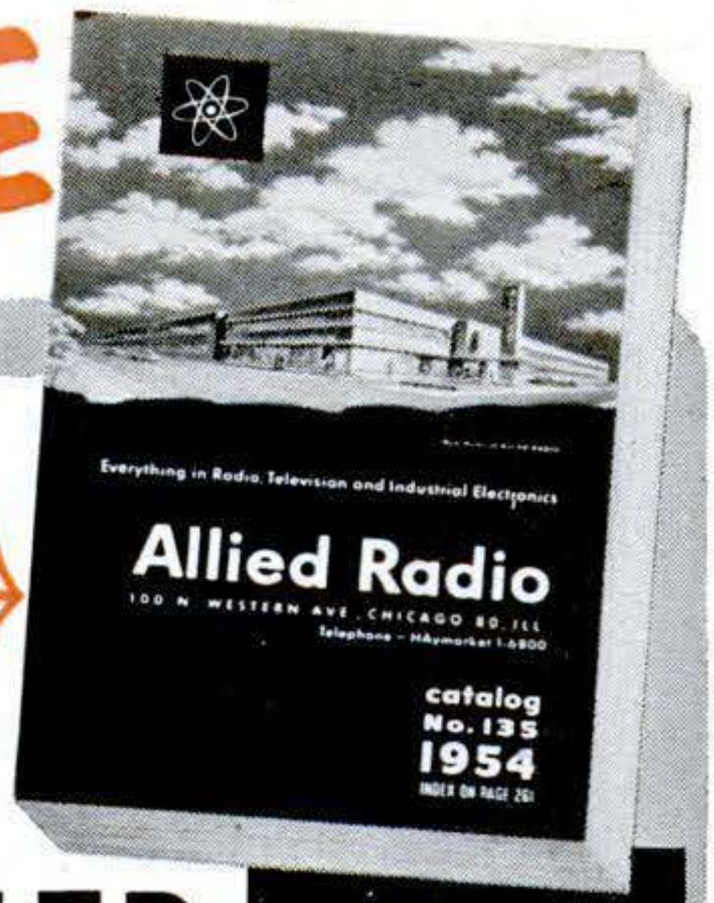

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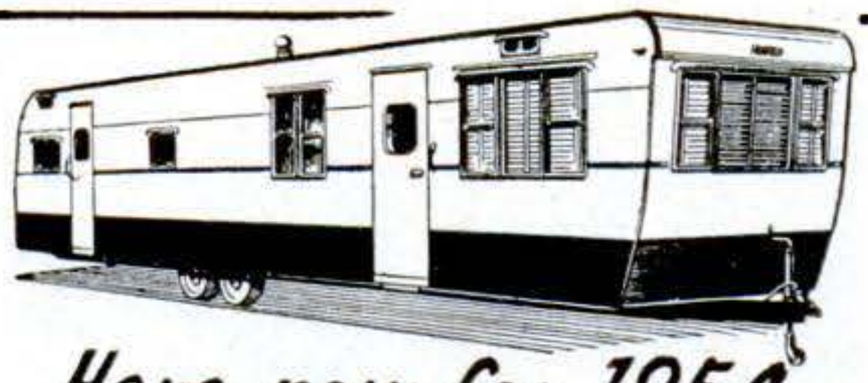

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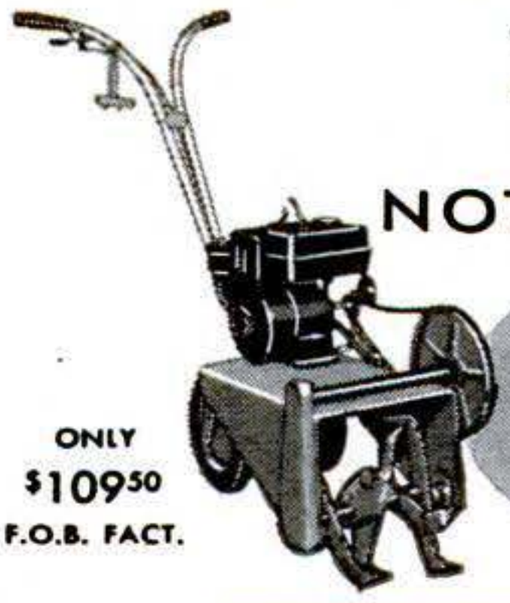

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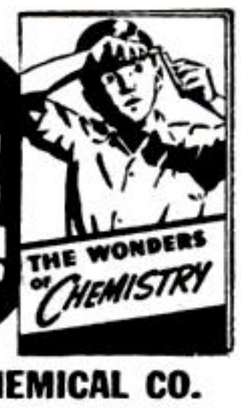

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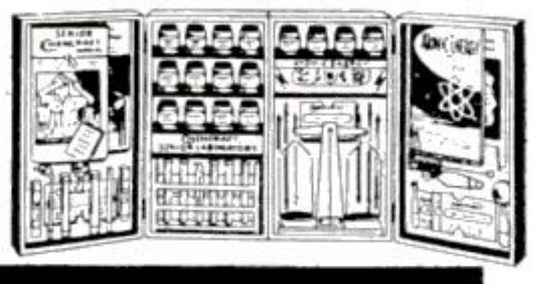

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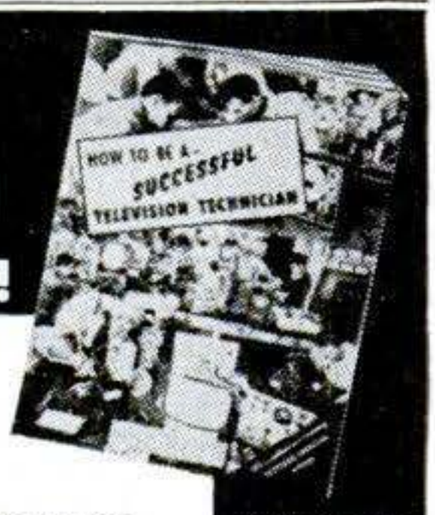

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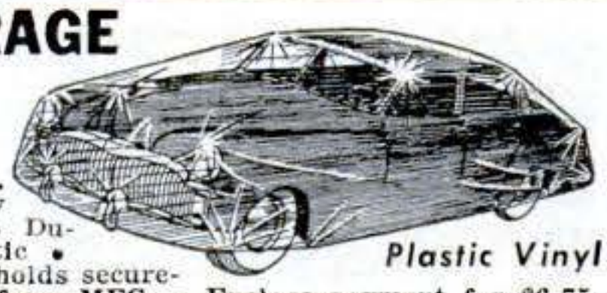

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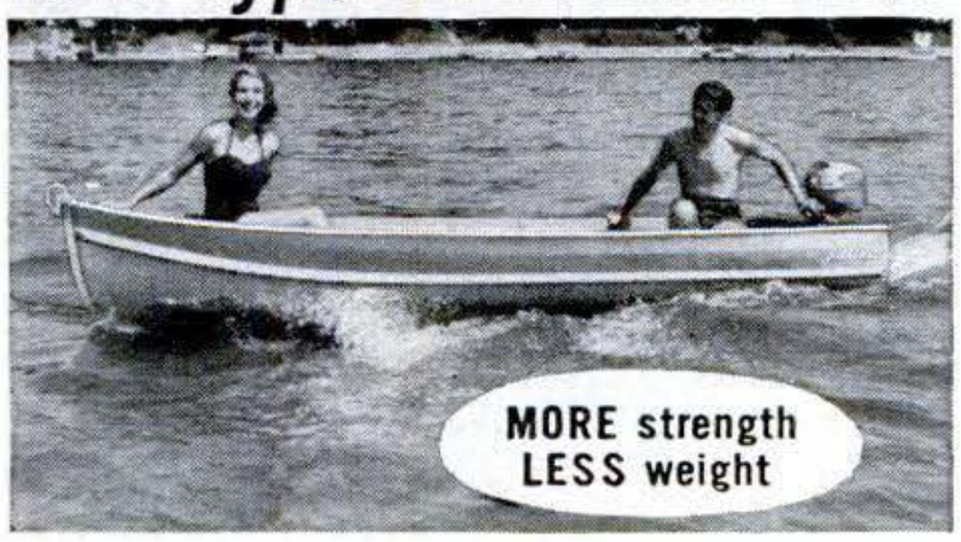

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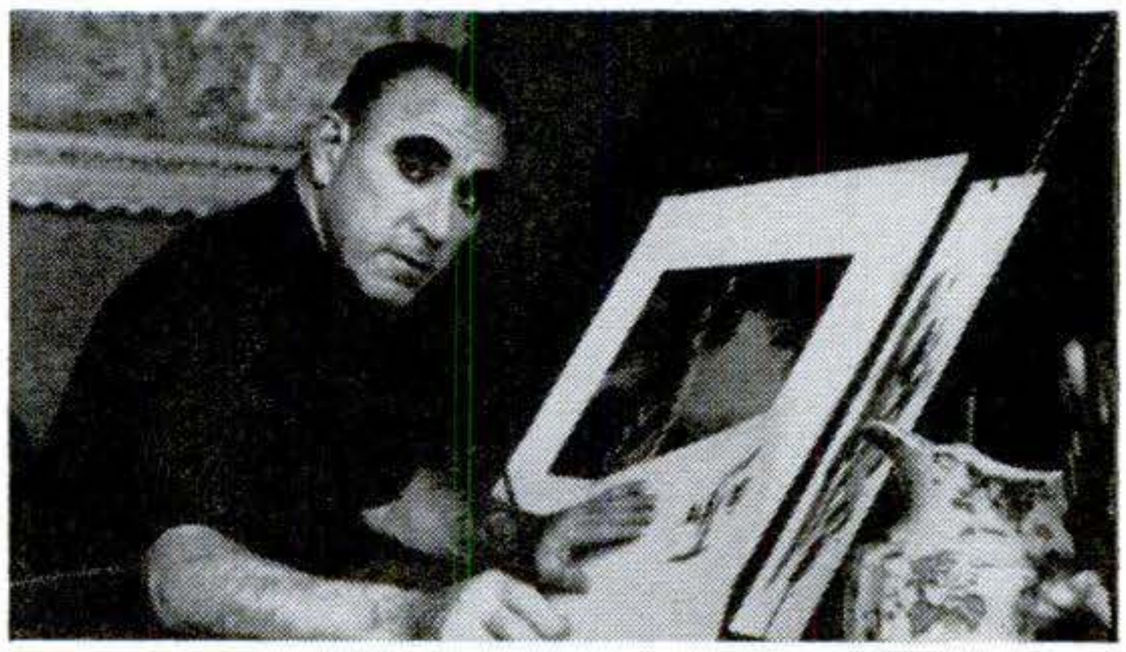

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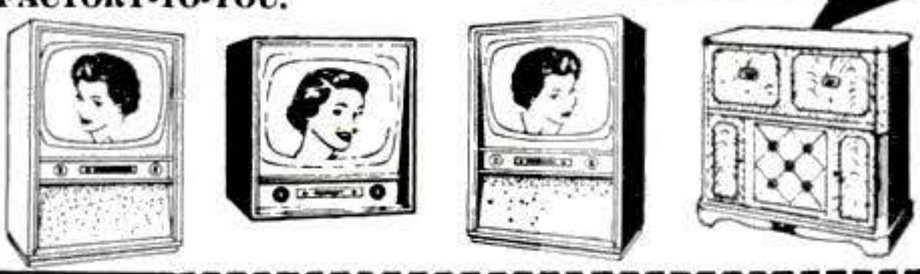

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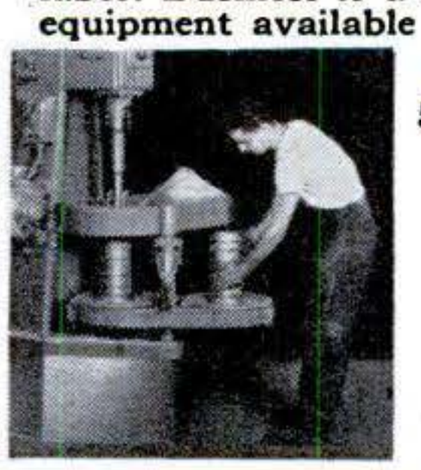

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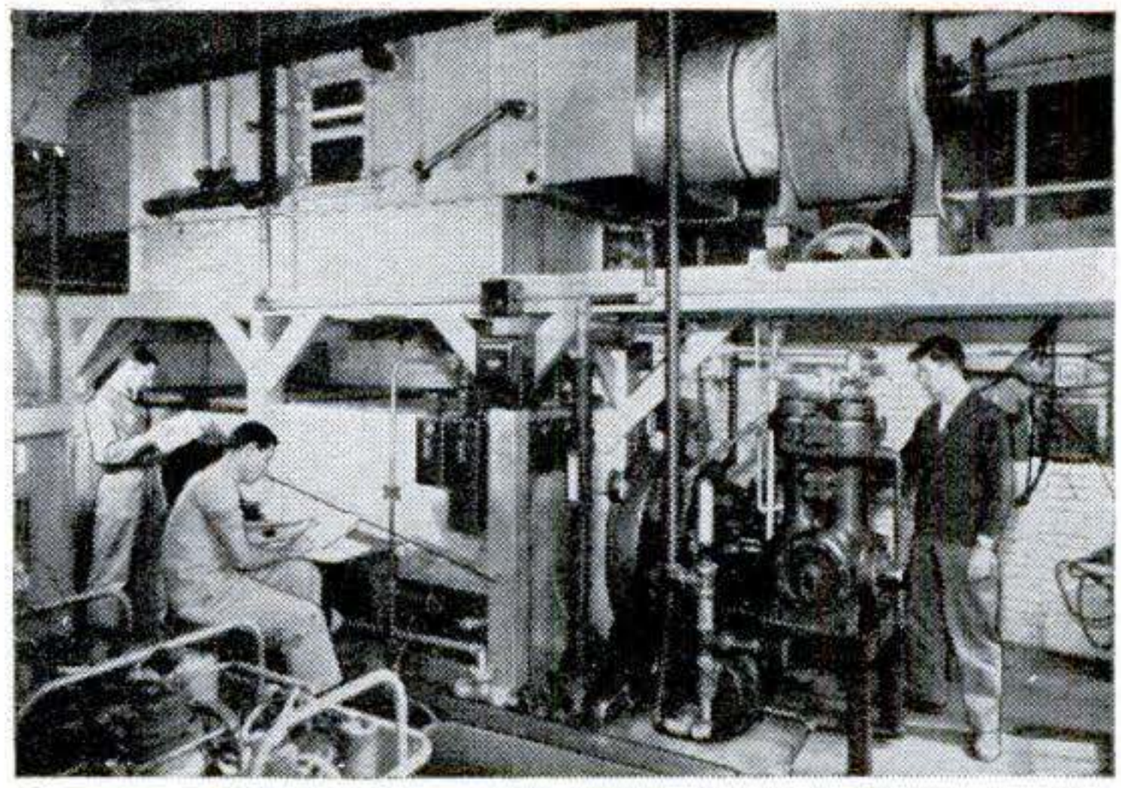

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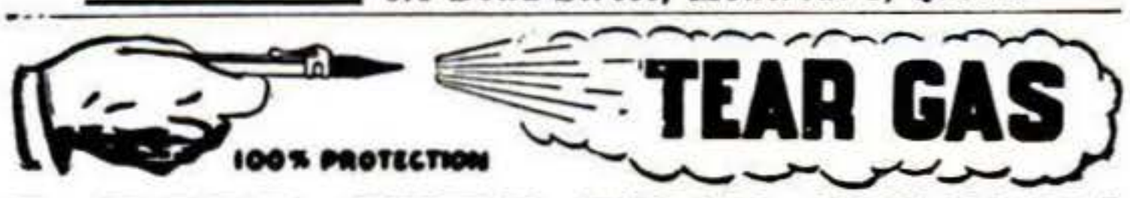

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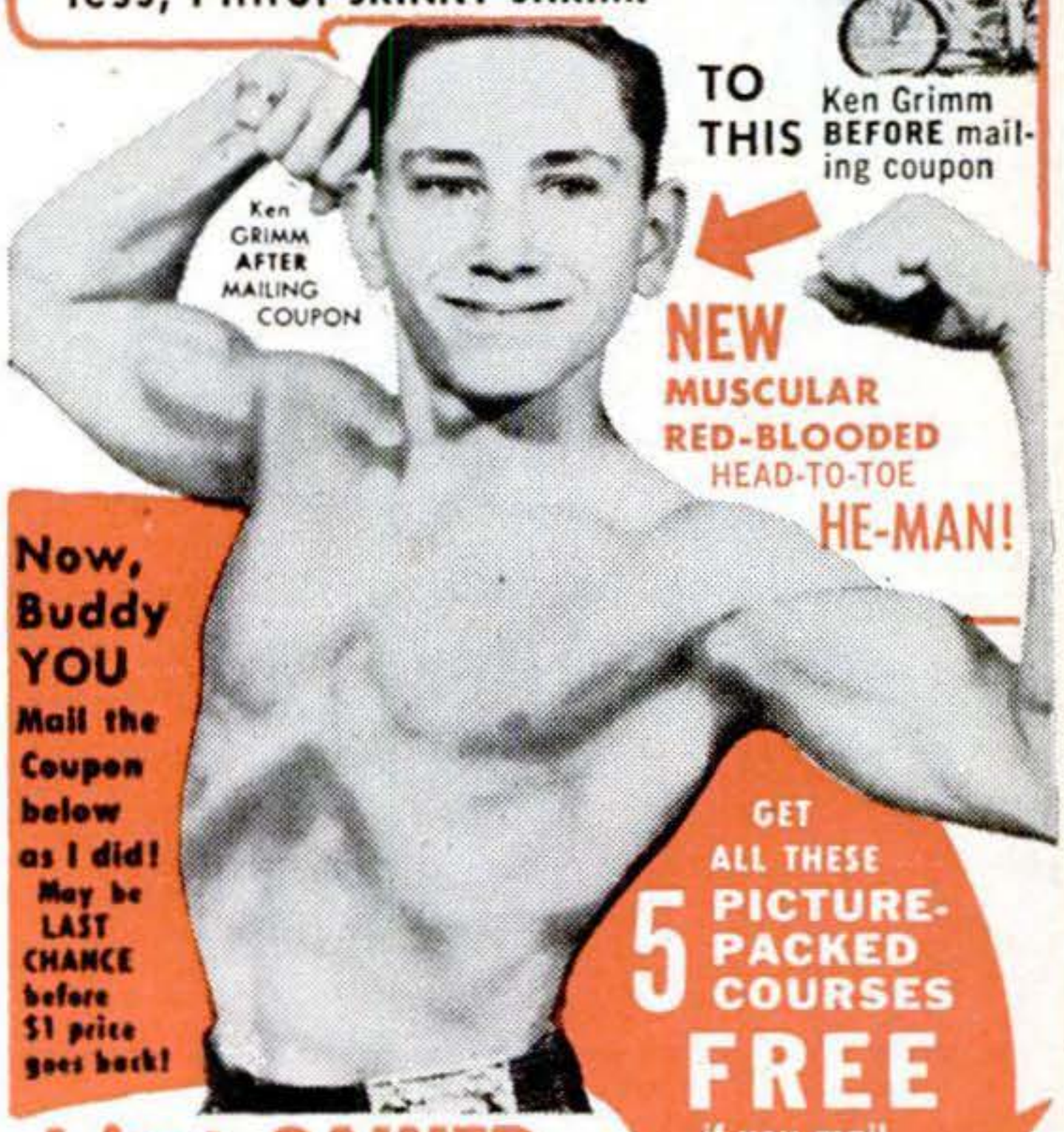

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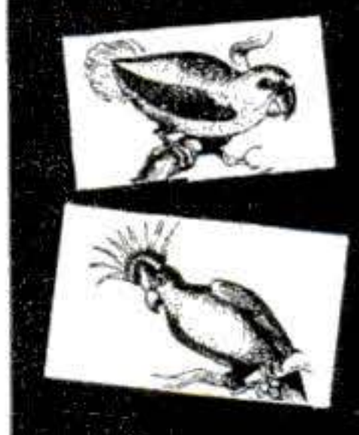

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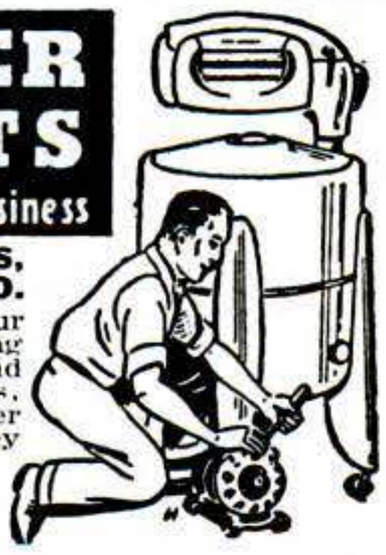

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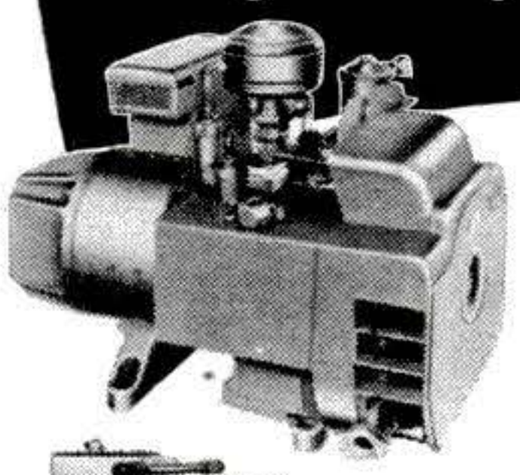

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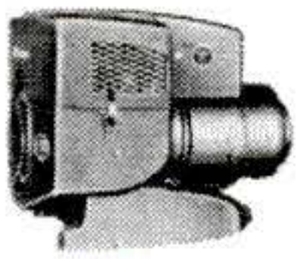

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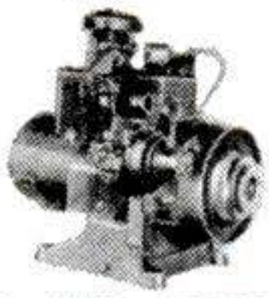

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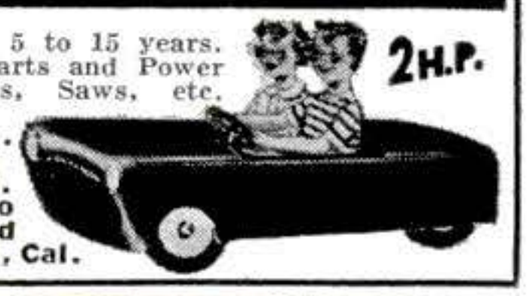

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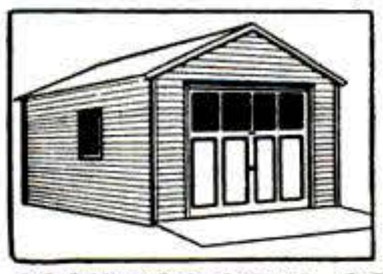

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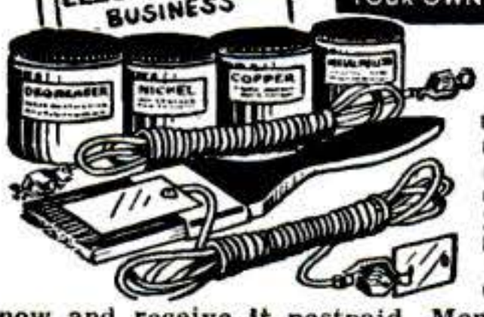

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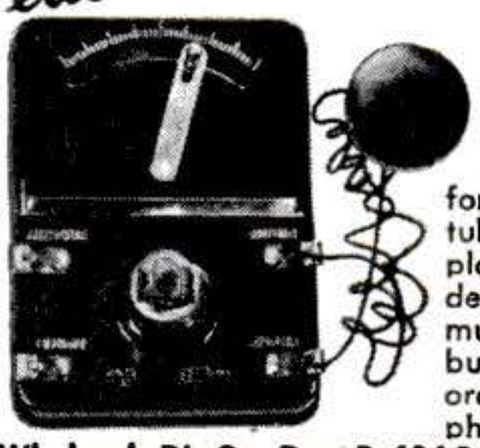

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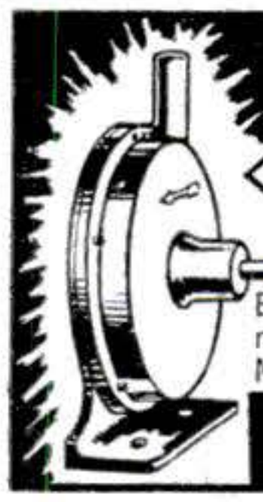

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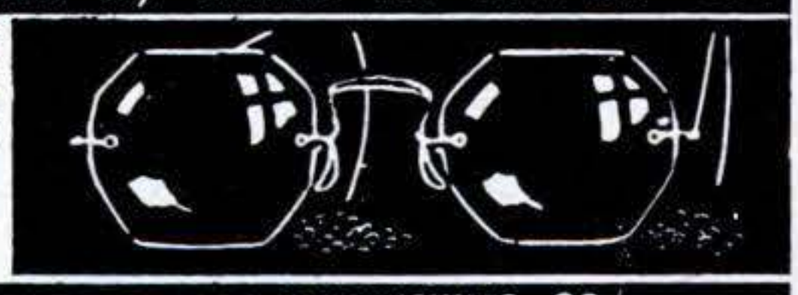

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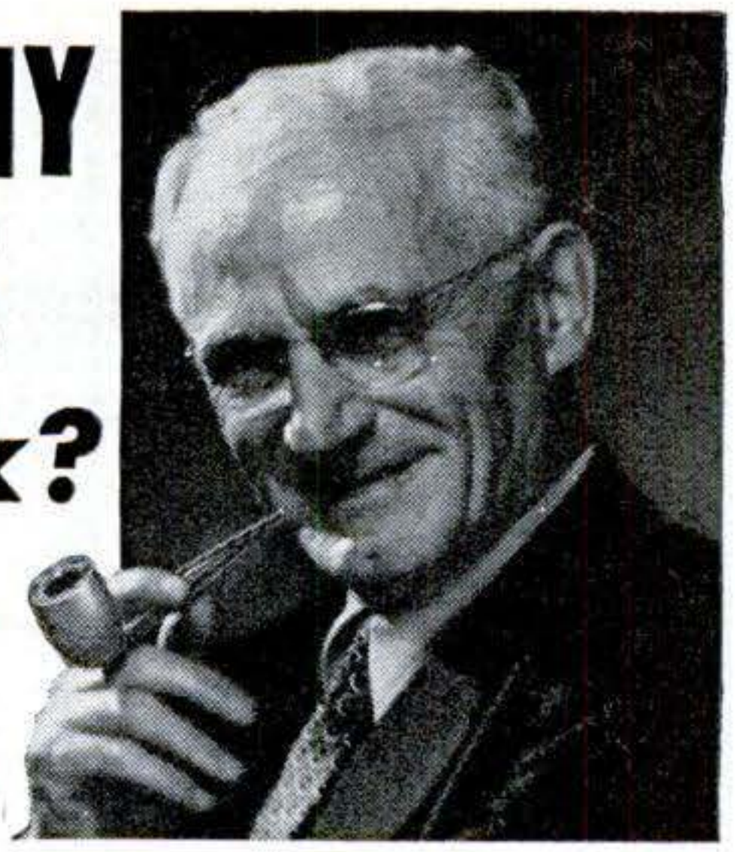

By E. A. CAREY

Pipes are my hobby—not my business—yet I've discovered a completely new smoking principle. All I want is your name so I can write and tell you why I'm willing to send you my pipe for 30 days smoking without a cent of risk on your part.

My new pipe is not a new model, not a new style, not a new gadget, not an improvement on old style pipes. It is the first pipe in the world to use an ENTIRELY NEW PRINCIPLE for giving unadulterated pleasure to pipe smokers.

I've been a pipe smoker for 30 years—always looking for the ideal pipe—buying all the disappointing gadgets — never finding a single, solitary pipe that would smoke hour after hour, day after day, without bitterness, bite, or sludge.

With considerable doubt, I decided to work out something for myself. After months of experimenting and scores of disappointments, suddenly, almost by accident, I discovered how to harness four great natural laws to give me everything I wanted in a pipe. It didn't require any "breaking in". From the first puff it smoked cool—it smoked mild. It smoked right down to the last bit of tobacco without bite. It never has to be "rested". AND it **never has to be cleaned!** Yet it is utterly impossible for goo or sludge to reach your tongue, because my invention dissipates the goo **as it forms!**

You might expect all this to require a complicated mechanical gadget, but when you see it, the most surprising thing will be that I've done all this in a pipe that looks like any of the finest conventional pipes.

The claims I could make for this new principle in tobacco enjoyment are so spectacular that no pipe smoker would believe them. So, since "seeing is believing", I also say "Smoking is convincing" and I want to send you one Carey pipe to smoke 30 days at my risk. At the end of that time, if you're willing to give up your Carey Pipe, simply break it to bits—and return it to me—the trial has cost you nothing.

Please send me your name today. The coupon or a postal card will do. I'll send you absolutely free my complete trial offer so you can decide for yourself whether or not my pipe-smoking friends are right when they say the Carey Pipe is the greatest smoking invention ever patented. Send your name today. As one pipe smoker to another, I'll guarantee you the surprise of your life, FREE. Write E. A. Carey, 1920 Sunnyside Ave., Dept. 1443, Chicago 40, Illinois

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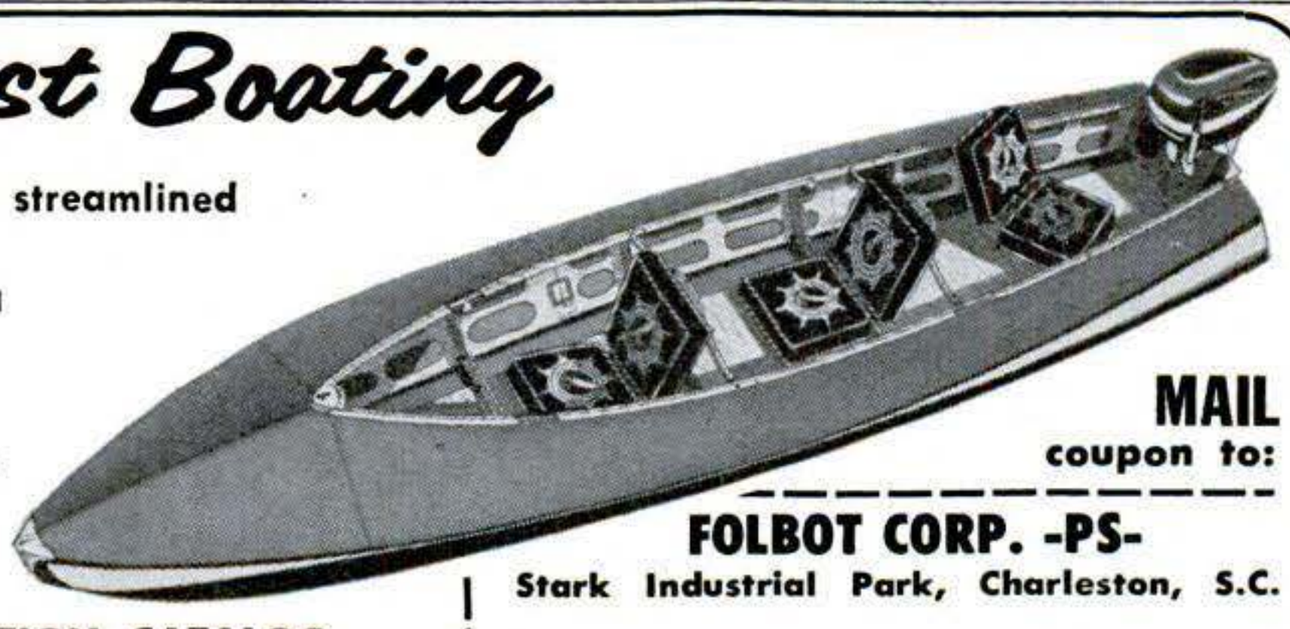

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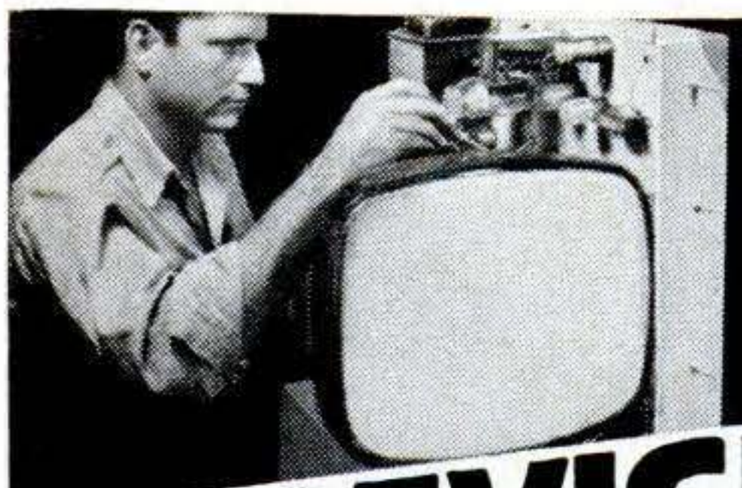

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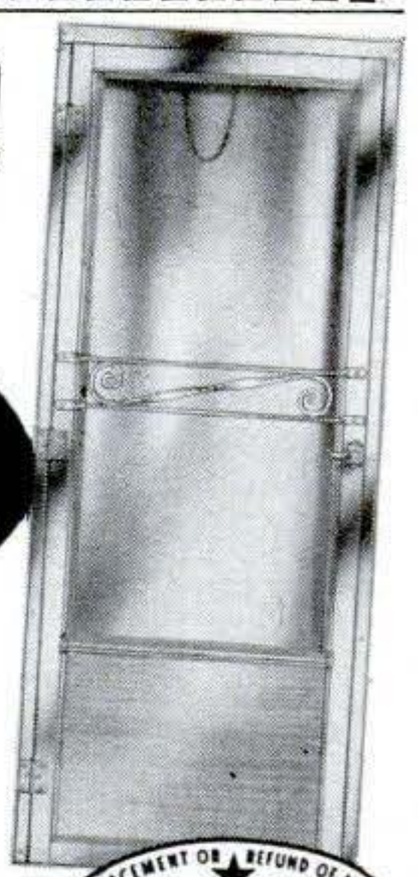

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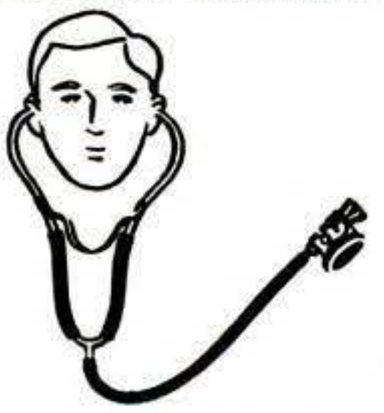

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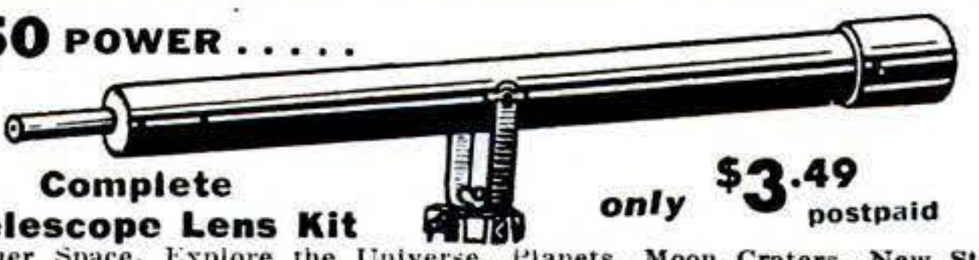

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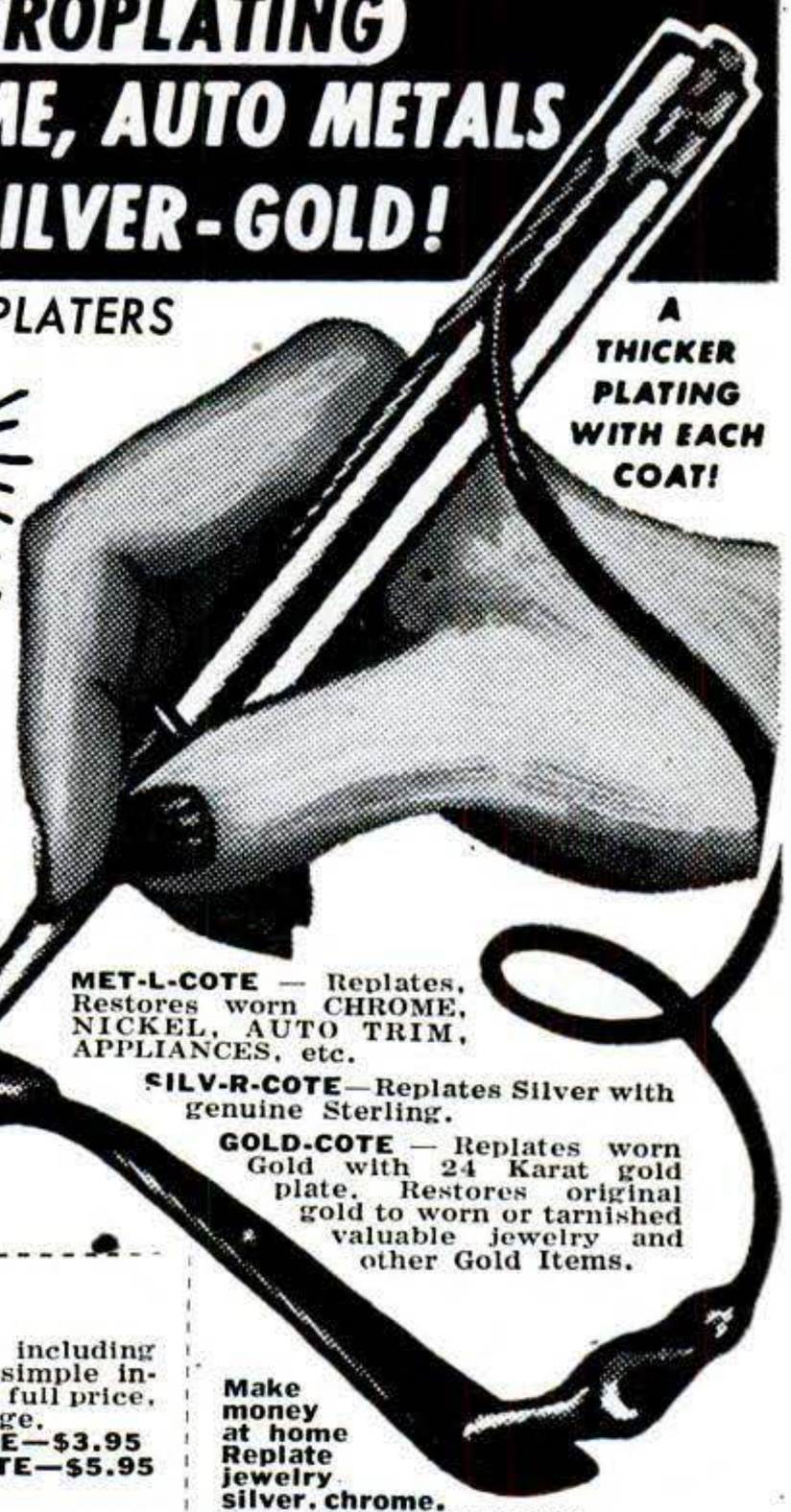

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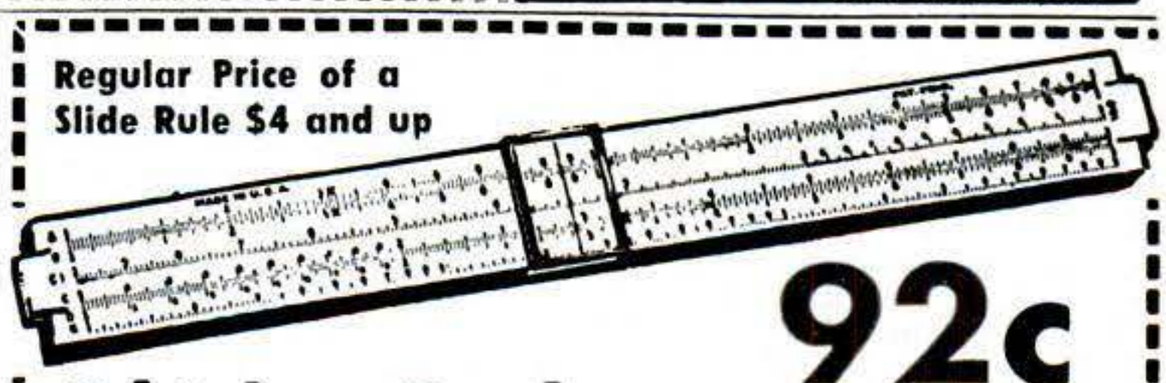

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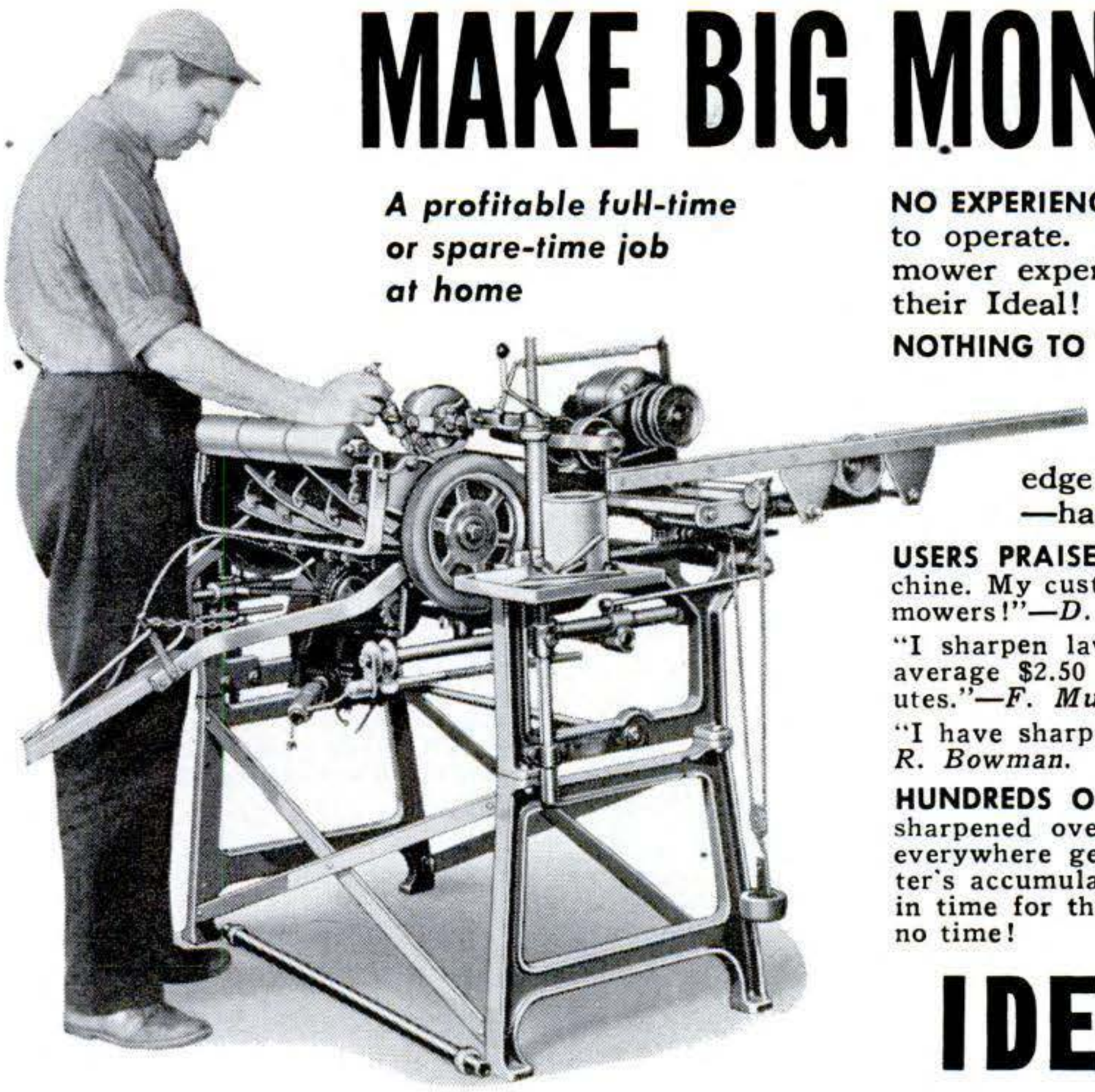

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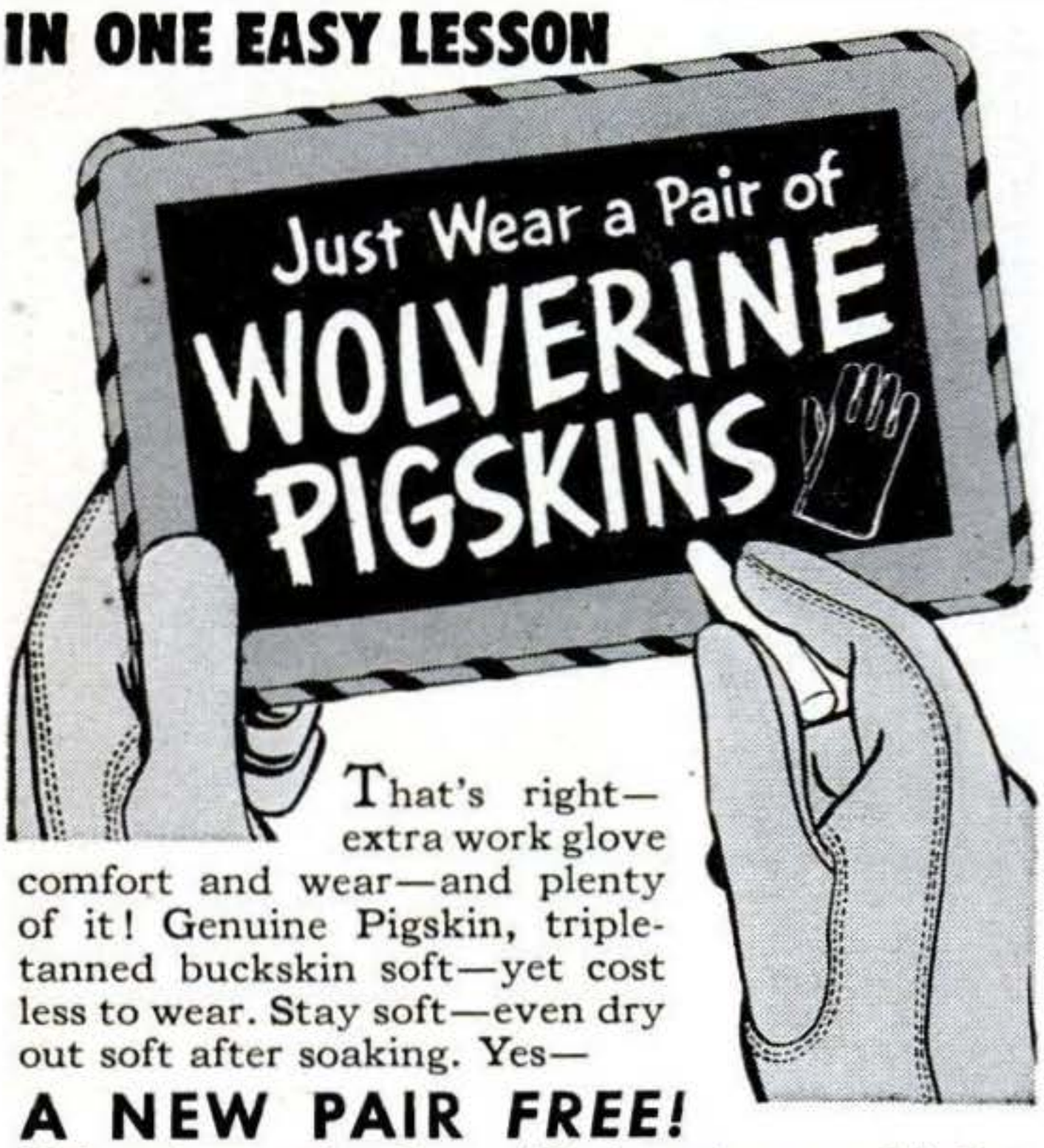

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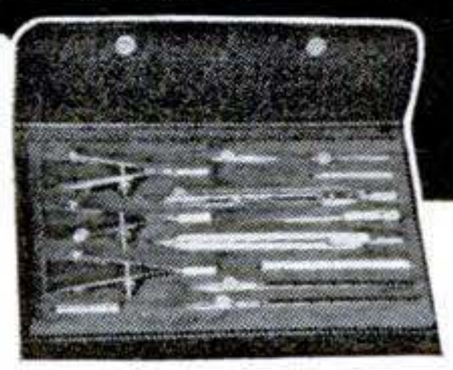

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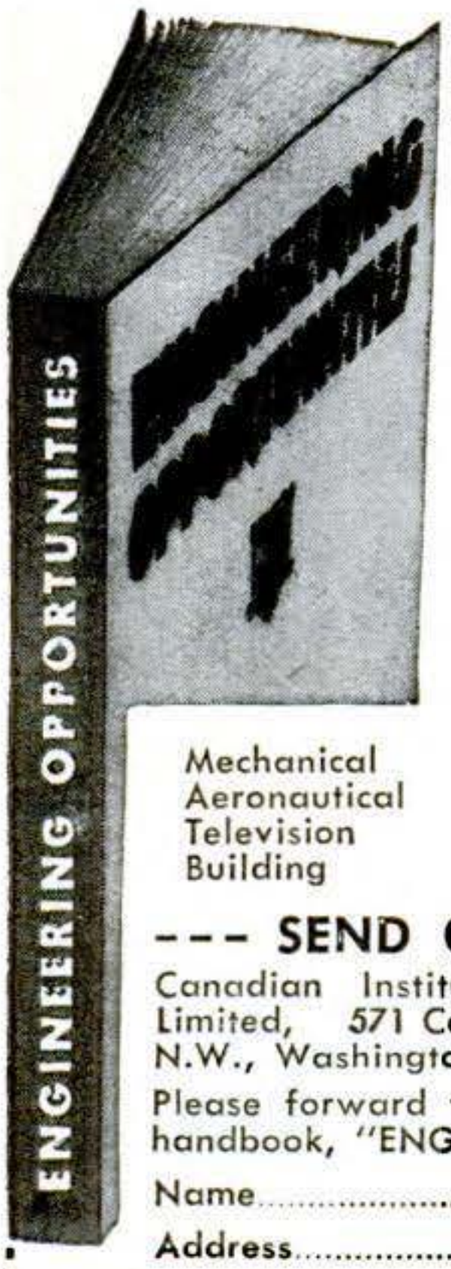

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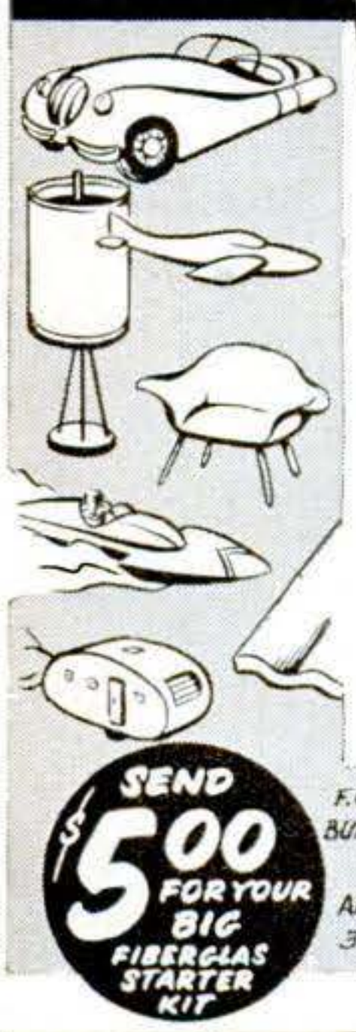

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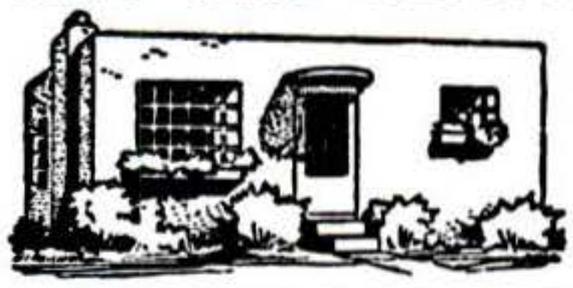

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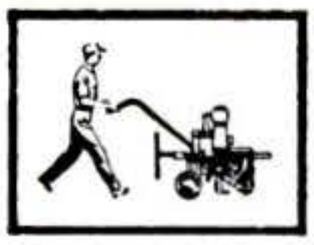

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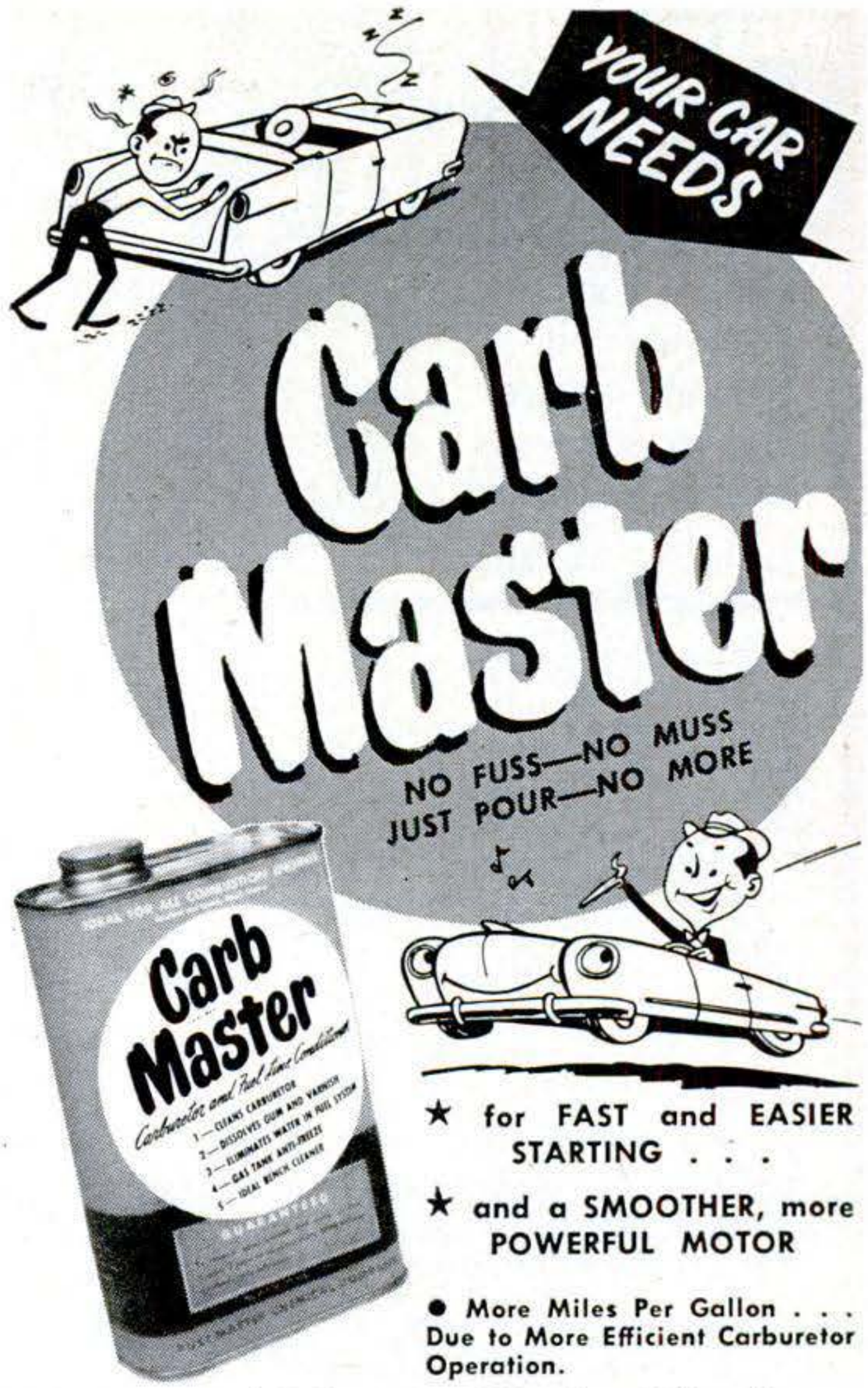

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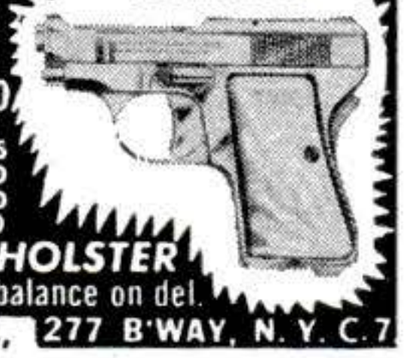

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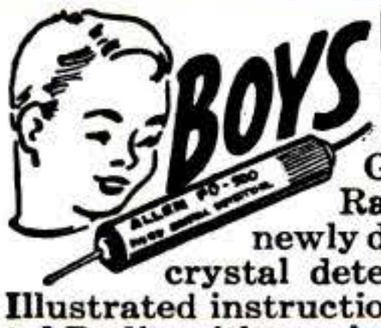

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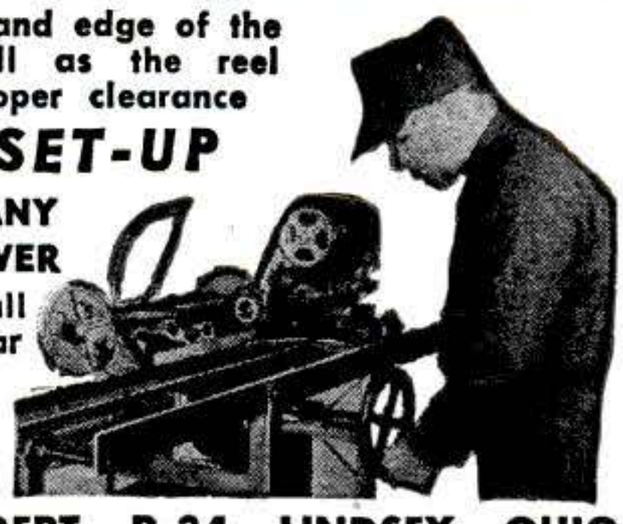

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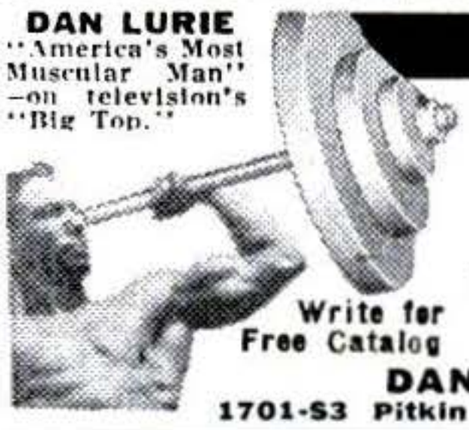

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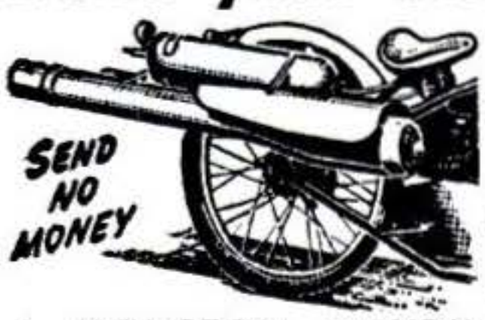

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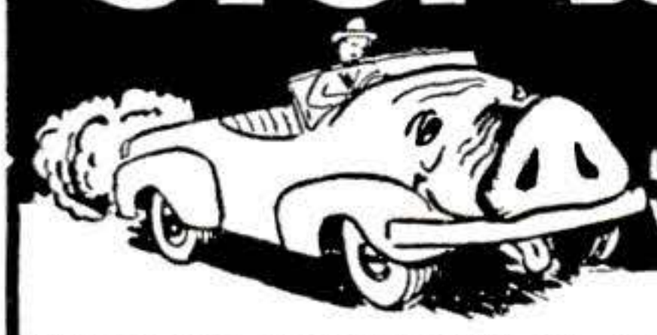

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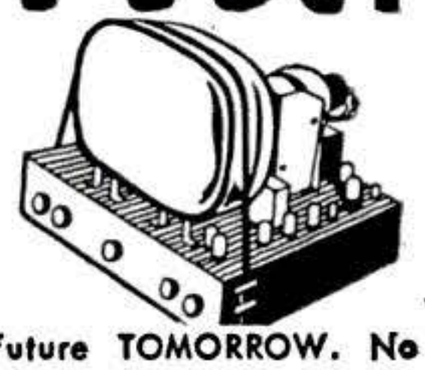

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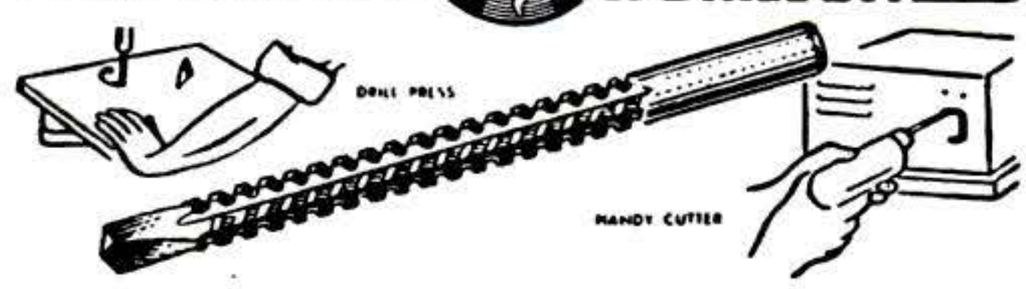

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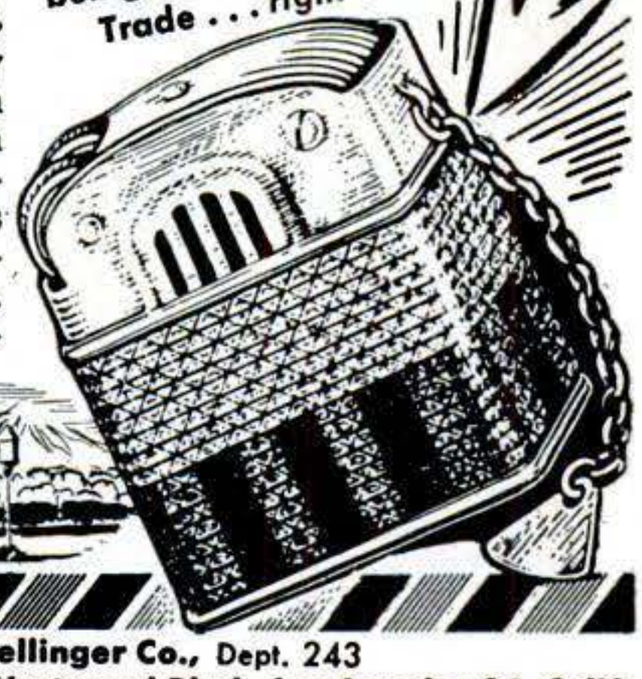

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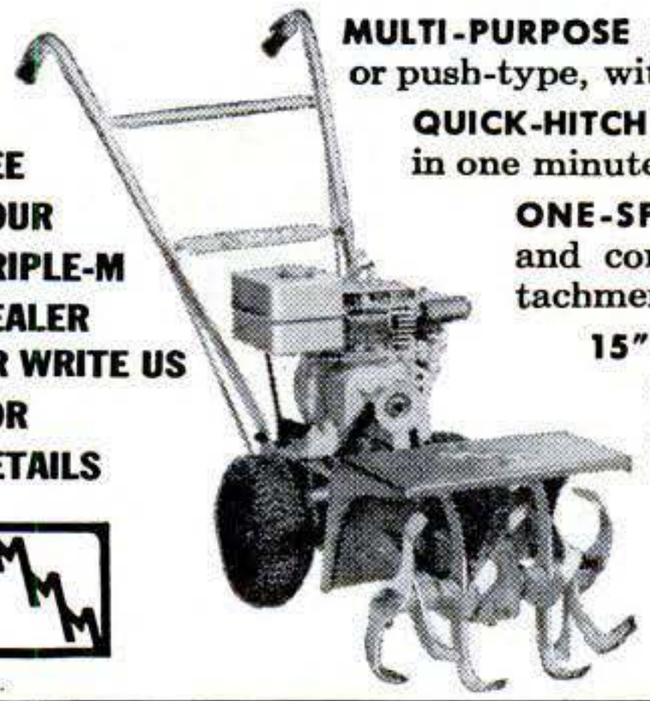

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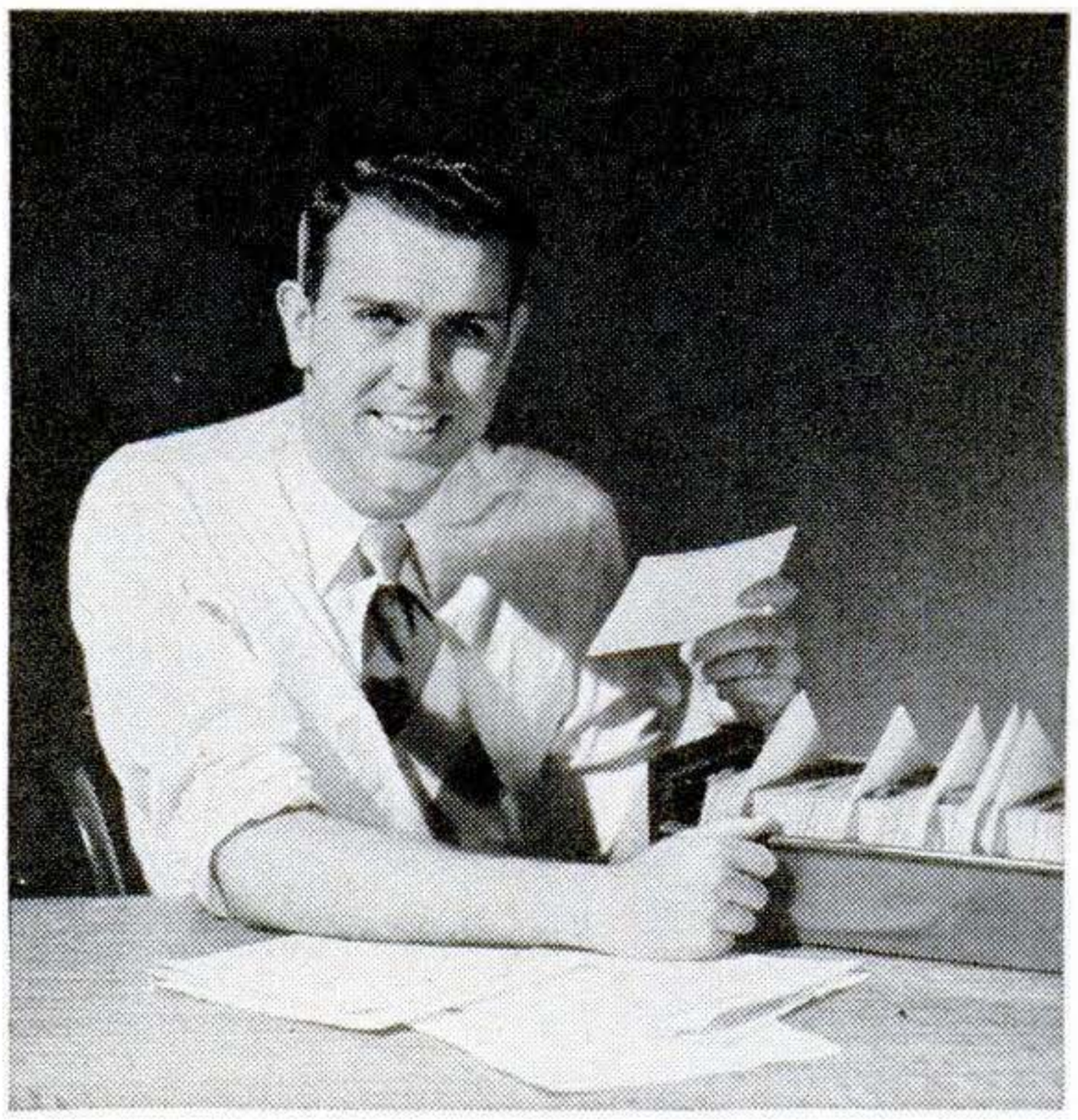

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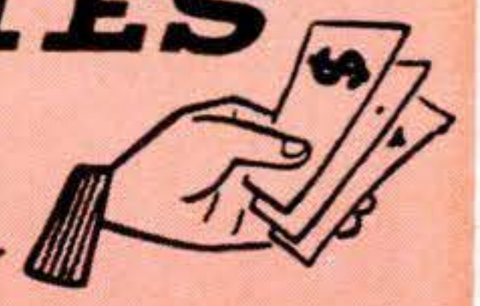

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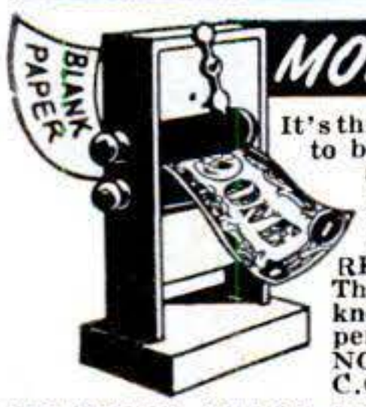

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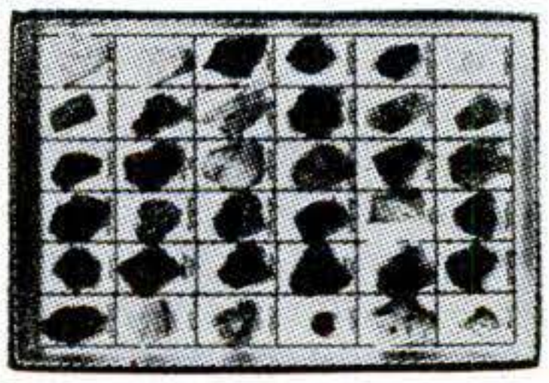

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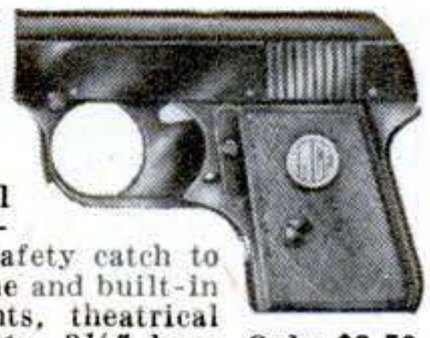

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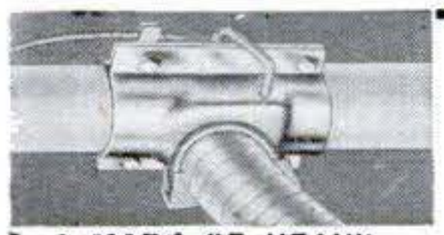

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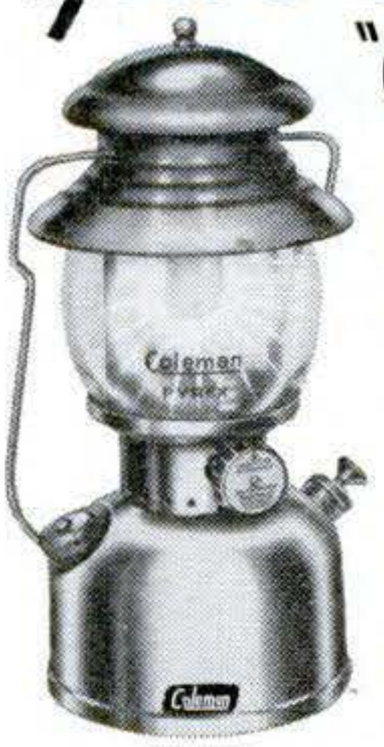

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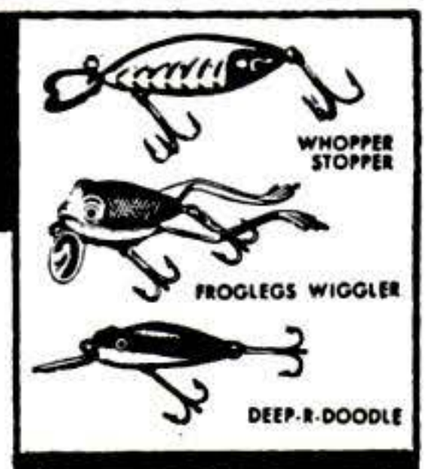

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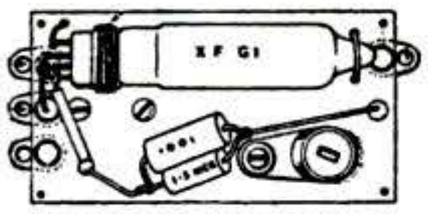

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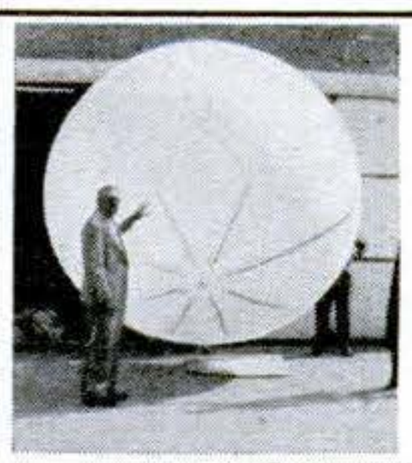

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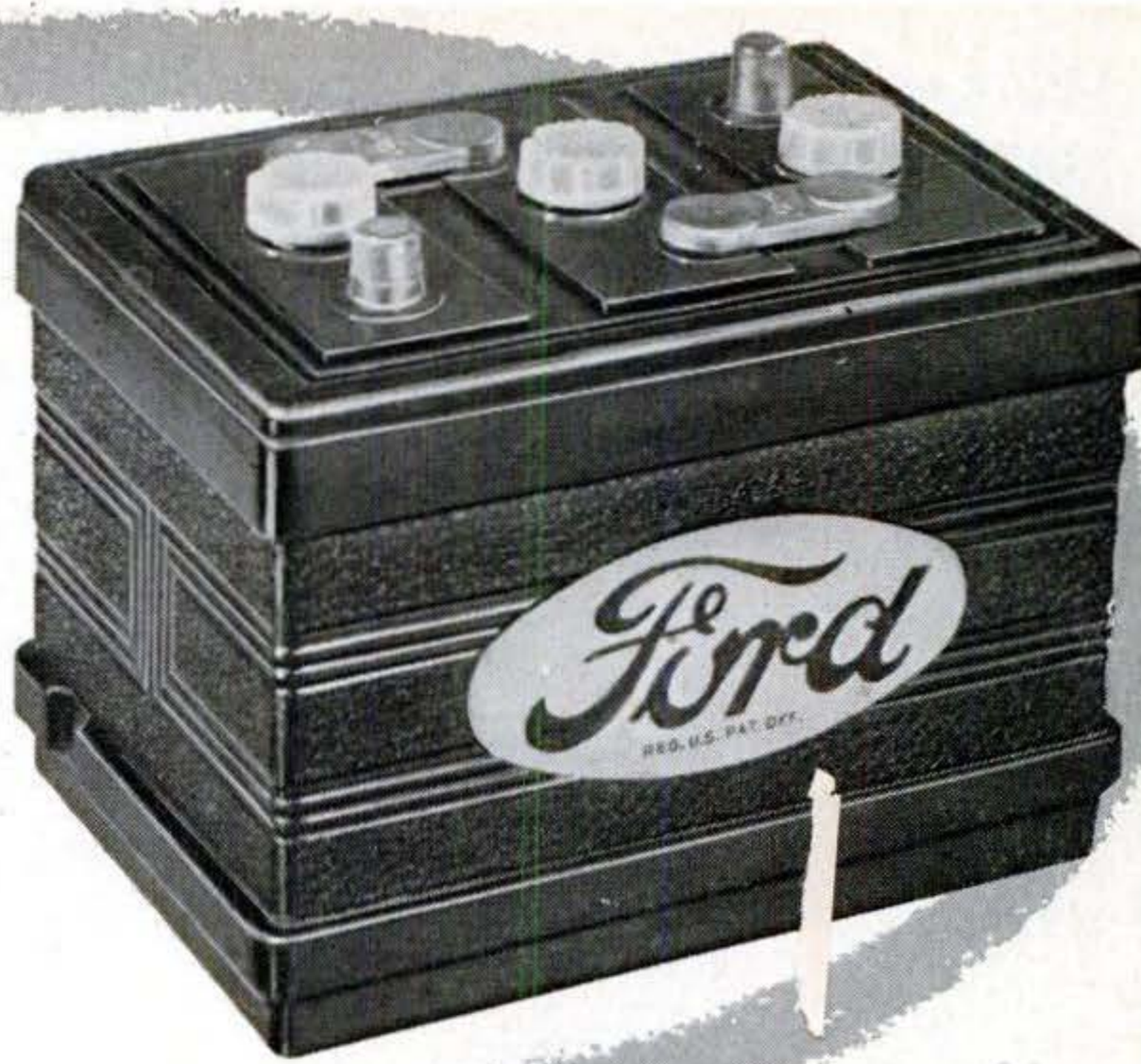

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POPULAR SCIENCE MONTHLY'S . . . **Last minute news & notes**

THAT FORD SPORTS CAR--MATCHING CHEVVY'S CORVETTE--is here, but don't look for it on a showroom floor for some months to come. Shown "in clay" by the stylists late in February, it will be running on the test track this month. Actual production will be slow. Goal: maybe 15,000 units a year . . . A truck powered by a gas-turbine engine is coming from a big Detroit maker. And soon . . . Knee-action rear wheels are a good bet for one of the luxury cars in '55.

THE KILLER IN "KILLER FOG"--the kind that caused 4,000 deaths in London last year--may be a combination of two chemicals, reports Harvard's Dr. Mary O. Amdur. She found that sulfur dioxide and sulfuric acid mist together caused much greater harm to guinea pigs than sulfuric acid alone . . . American health is getting better and better, according to statisticians of the Metropolitan Life Insurance Co. Deaths from nearly all diseases and accidents were fewer last year. Among children--infants excepted --the death rate is nearing "an irreducible minimum." Even auto fatalities stayed at same level.

RAINDROPS COME IN ALL SHAPES AND SIZES--but hardly ever in the tapered pear shape that artists draw. Two meteorologists of the Illinois State Water Survey back that finding with 200,000 photos of raindrops, made to improve radar forecasting of rain. The pictures show that the most common drop form is a fat mushroom, but many other shapes result when big drops shake themselves to pieces (see sketches at left) . . . Pilot lights are eliminated in many of the new gas ranges. They have electric igniter coils to light top burners, oven or broiler. Keeps the kitchen cooler and also avoids danger that pilot might accidentally go out.

LUBRICATING THE WINGS OF SUPERSONIC PLANES WITH LIQUID HELIUM cuts the heat caused by skin friction in half, tests at Bell Aircraft indicate . . . Farmers are trapping turkey rustlers with television. They tune their sets to an off-the-air station, then keep an eye on the viewing screens. The flash of engine-caused interference gives away the approach of a rustler's truck.

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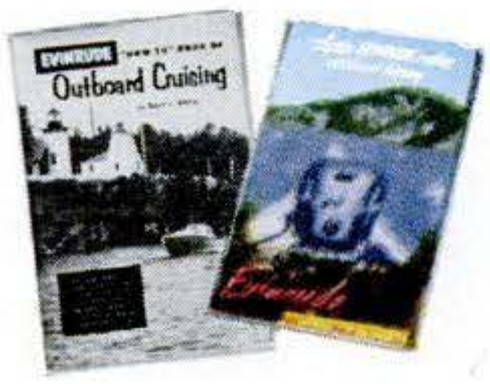

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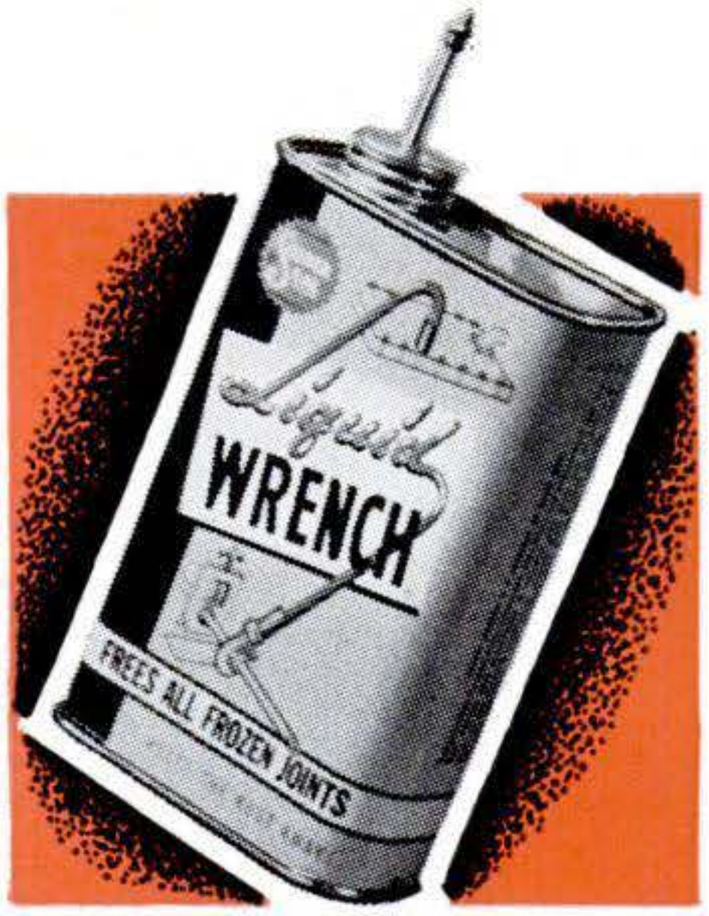

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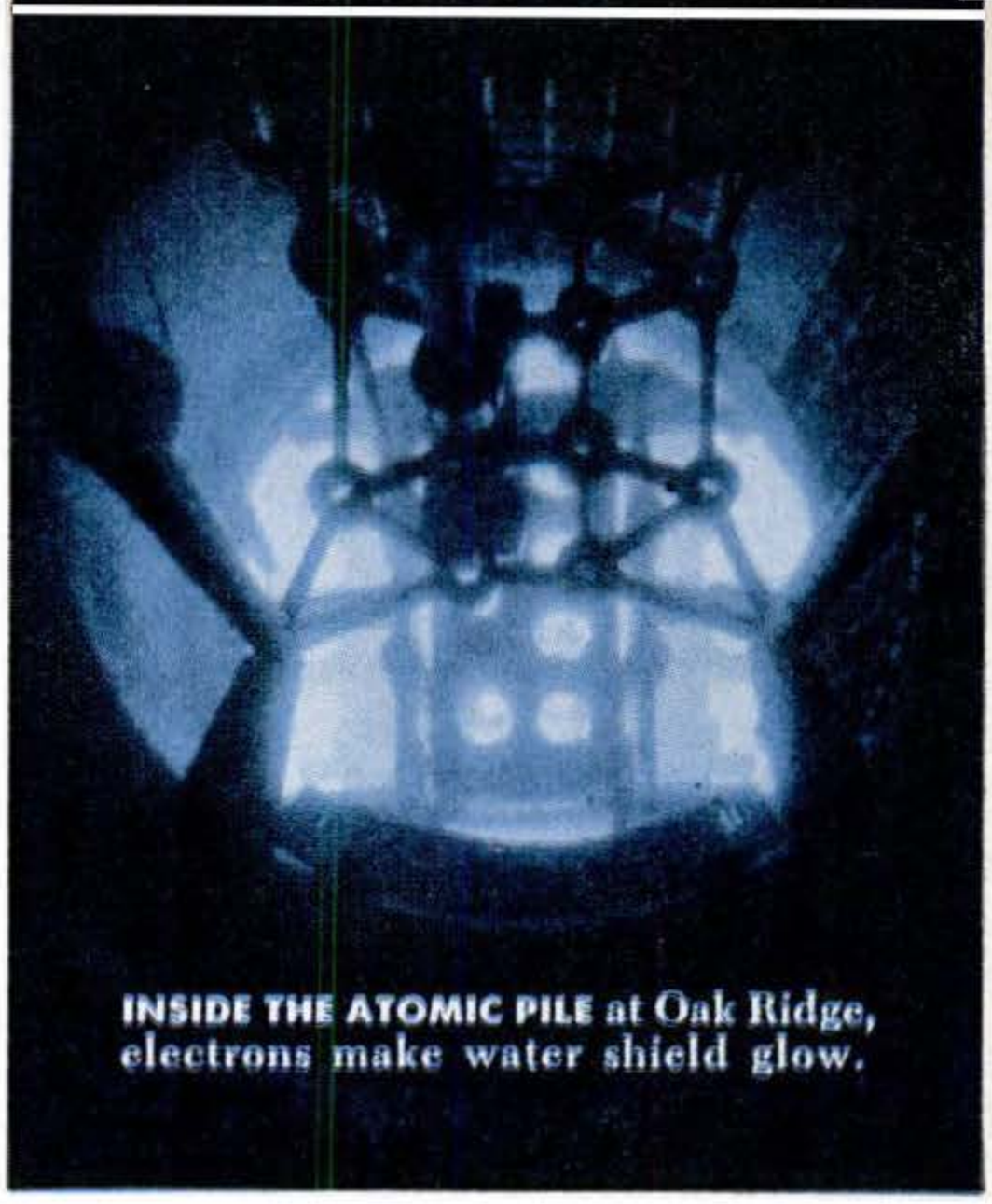
IF Atomic Fuel Were Shared...



INSIDE THE ATOMIC PILE at Oak Ridge, electrons make water shield glow.

The world would be healthier, wealthier and wiser, say AEC scientists, discussing President's daring proposal to United Nations.

EDITOR'S NOTE:

President Eisenhower's dramatic proposal to the United Nations that a world pool of fissionable materials be created for peaceful purposes had no greater appeal to any hearts and minds than those of nuclear scientists.* POPULAR SCIENCE MONTHLY *invited some of them, on the staff of the Atomic Energy Commission's labs at Brookhaven, N.Y., to tell you what they think of the plan's potentialities. Their discussion, recorded on magnetic tape, is transcribed here. The various speakers are: William A. Higinbotham, Harry Palevsky, Drs. Clarke Williams, Marvin Fox and Charles P. Baker, physicists; Mrs. Beth Baker, a chemist: and Wesley S. Griswold, of PSM's editorial staff.

MR. GRISWOLD: What do you people think of the President's plan to pool fissionable materials for peaceful uses?

Dr. Fox: I think it's brilliant—a stroke of genius to solve this whole dilemma that has confronted us for the last half-dozen years.

Mr. Palevsky: It provides a central focal point that serves a very necessary purpose. It starts us off.

Dr. Baker: The Acheson-Lilienthal proposal, in 1946, was a brilliant proposal, but in order to get anywhere, you have to start. And with that proposal you had to start by taking off all your clothes and jumping in. Whereas in Eisenhower's proposal, you say, "Take off your coat, loosen your tie, and sit down." There are many people who will do this that won't go the whole way.

Griswold: If you were given the task of setting up such a pool, would you anticipate getting large amounts of fis-

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TOO "HOT" TO HANDLE casually, radioactive isotopes for medicine, industry and many fields of research are dealt with at tongs' length. The man at left above is aiming a

FROM NEW MEXICO, this second-rank uranium-bearing ore contains carnotite, uranophane.

FROM CANADA comes a fragment of pitch-blende, chief high-grade source of uranium.

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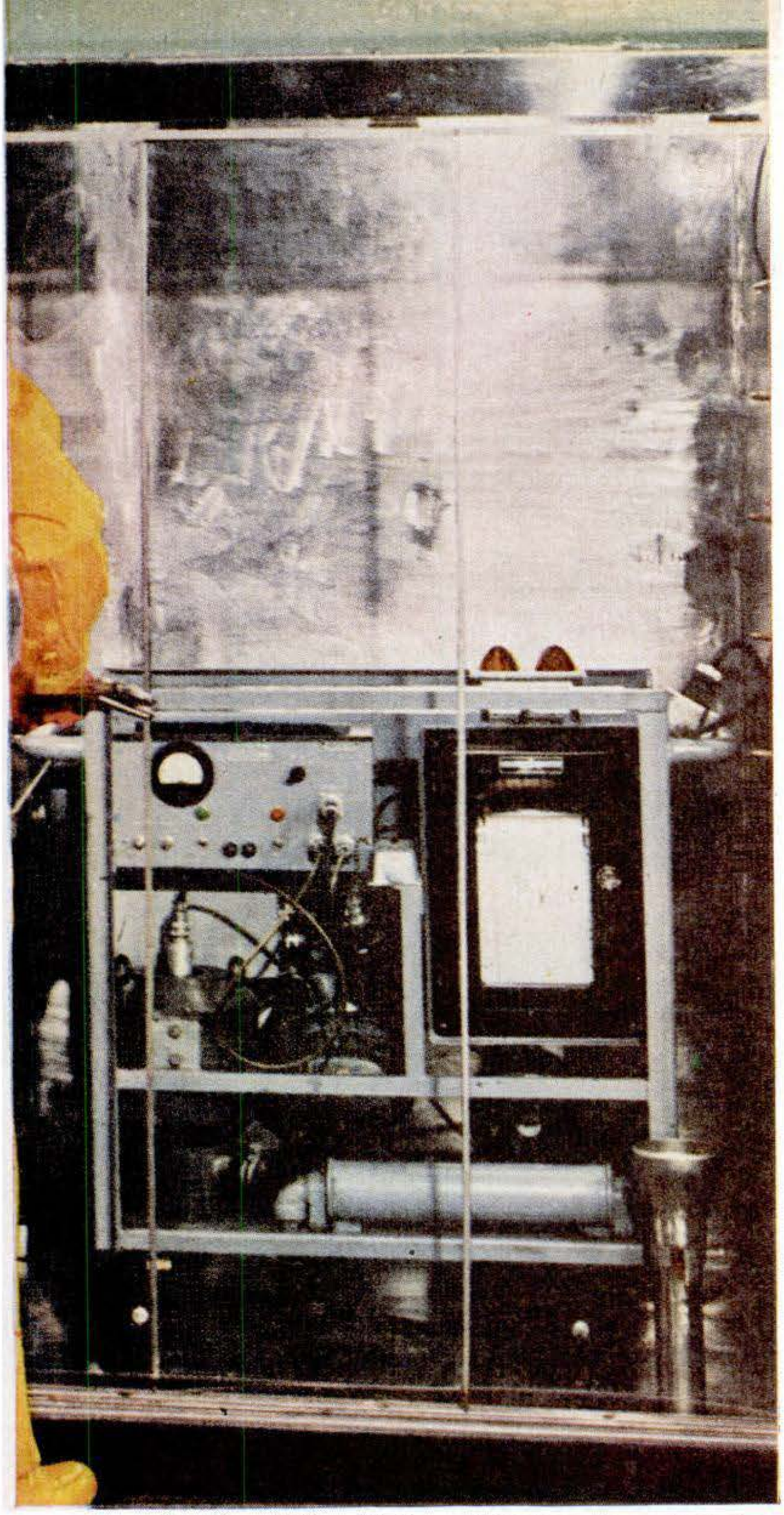


"cutie pie" radiation detector at an isotope. Such routines may soon become worldwide.

sionable materials, or small amounts?

Mr. Higinbotham: The fact is that no countries except Russia and the U.S. (which are well stocked) and England and Canada have the capital to buy—or, as a matter of fact, have access to—a substantial amount of source materials.

You see, thorium is useless until you've gone a long way with uranium and its products. And the U.S., Great Britain and Canada have virtually cornered the free-world market in uranium.

Palevsky: So the three of us and Russia control all the source materials, except for truly trivial quantities.

Higinbotham: The U.S. and Russia control a lot of materials, but they don't own them. I think the first step is to get these two major parties to loosen up on their controls, so that other people can play around.

I'm thinking of natural uranium and thorium ores—source material.

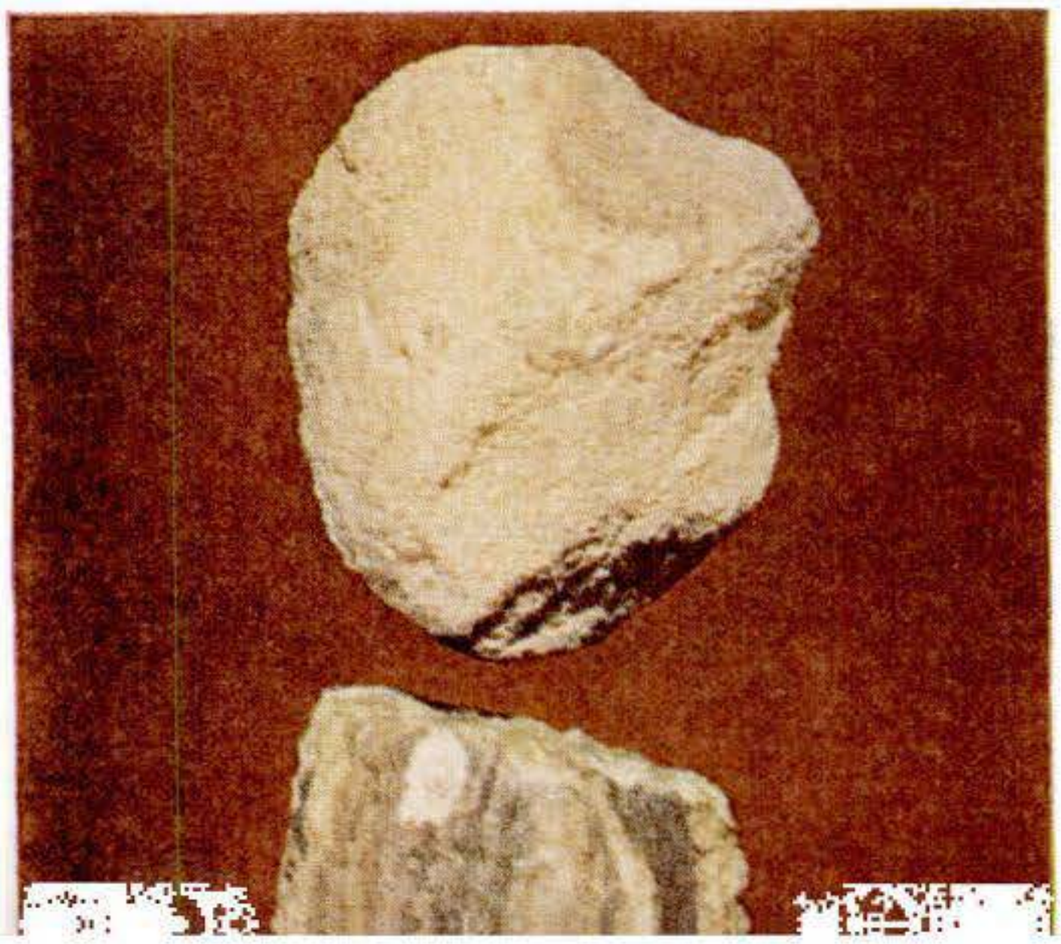
Griswold: You think, then, that it would be ores that would be contributed to this pool, and not enriched stuff?

Higinbotham: Yes.

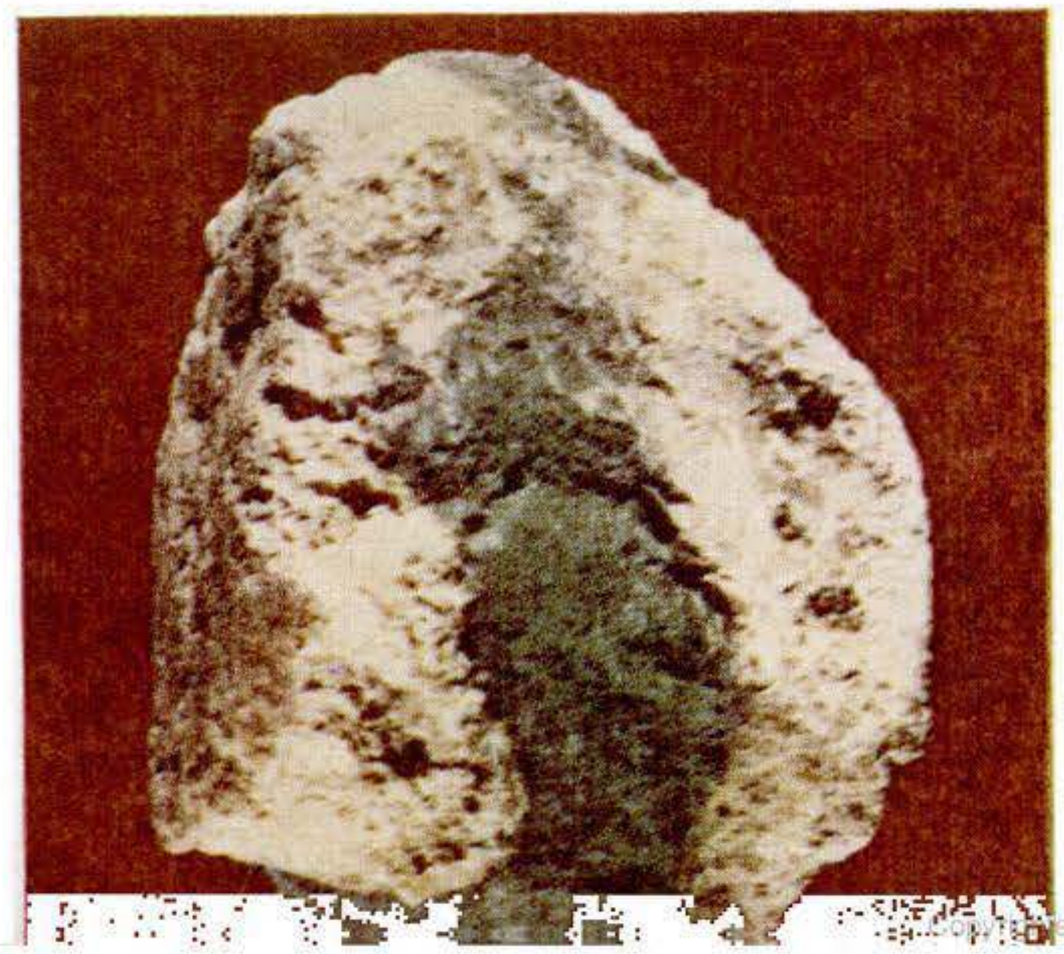
Griswold: How would you ship the materials to the pool?

Higinbotham: I suspect that you are thinking of this pool as a big concrete building somewhere, loaded with radioactive stuff. It seems to me that what Eisenhower contemplates will be a holding company, like the AEC. The stuff will be stockpiled all over the world. It will go by the pound or the truckload

FROM THE COLORADO PLATEAU of Utah and Colorado come bright chunks of carnotite.



FROM THE BELGIAN CONGO, this rock contains a fat vein of universally sought pitchblende.



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or the shipload direct from the donor to research laboratories in different countries all over the world.

Griswold: Is it dangerous to ship? Would it require shielding?

Fox: Not in ore form.

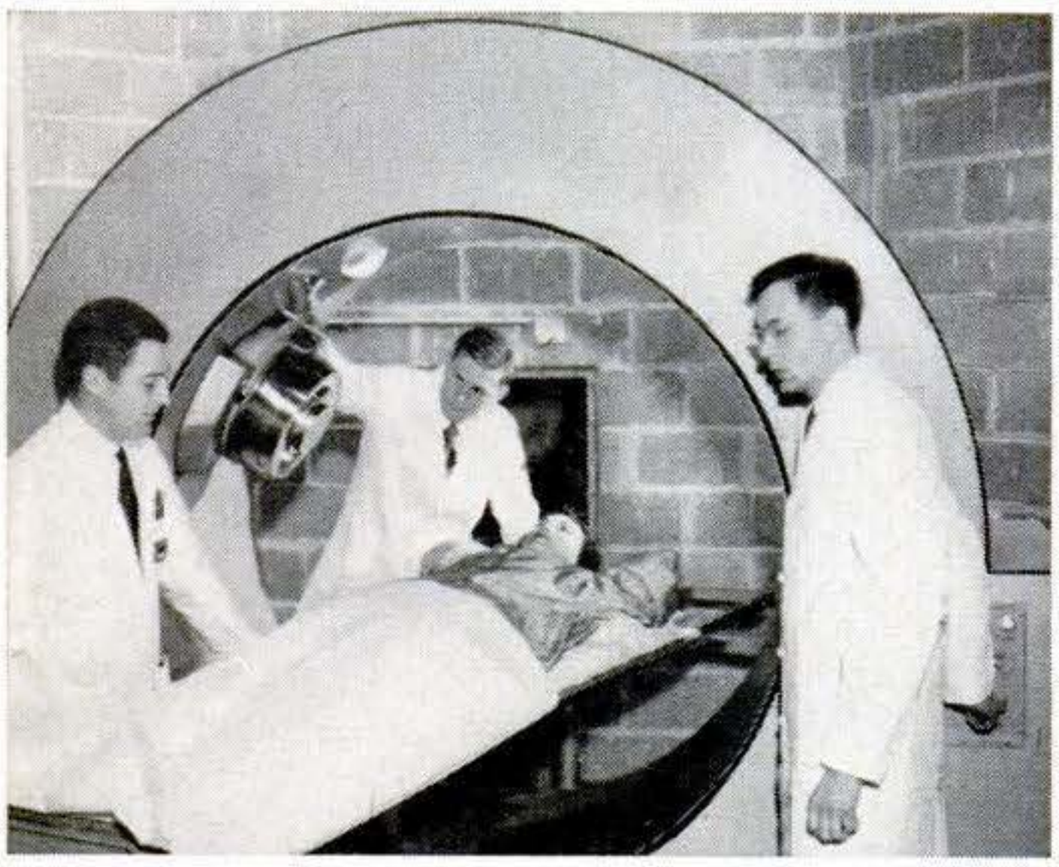
Griswold: What does the stuff look like?

Fox: Well, uranium is shiny silver when freshly made but tarnishes to brown or black quickly when it's exposed to the air.

Griswold: I've heard that it can be obtained in fairly small ingots, almost the size of flashlight batteries.

Fox: You can get it in any size you like.

Griswold: What countries besides the ones you have already mentioned would be likely to have surplus fissionable materials for the world pool?



HEAVY ARTILLERY against cancer is this doughnut-shaped gun that aims rays from Cobalt 60 at the universal enemy. Atomic "weapons" like these may become available to everyone.

Baker: I think you should include the Belgian Congo, South Africa and Czechoslovakia—if you can distinguish that country from Russia.

Higinbotham: You'd also include India and Brazil, wouldn't you?

Baker: Oh, yes.

Higinbotham: India and Brazil would most assuredly be interested in the power potentialities of a world atomic pool. Brazil is peculiarly poor in water resources. The waterfalls are a long way from the coast. The Amazon is flat for many, many miles inland. I think the Brazilians are working small streams mostly.

As a result, Rio and Sao Paulo, the two biggest cities—about 200 miles apart with decidedly mountainous country between—have a common power supply. And they are so hard up for electricity that the different sections of the cities are shut down in succession.

Griswold: Is it possible that we can have smaller atomic power plants than any yet built—plants that could be used, say, to run planes and trains?

Fox: Oh, yes.

Dr. Williams: Especially Russian trains, which are broader gauge. *[Laughter.]*

Griswold: But not small enough to run automobiles?

Higinbotham: Well, the only possibility in this line is that someone might design a really good battery that you could have charged at an atomic power station, and then run your car by electricity.

Baker: There are other ways. If you had cheap power you could store it chemically by taking water and carbon dioxide and making gasoline out of them, then pouring the gasoline into your car. *[Laughter.]* Well, if you had cheap power, you *could* do this.

Palevsky: That's true. If you can make cheap power, there are just unlimited processes that could be developed.

If you can reduce the cost of power by, say, 20 or 30 percent, I think that many new industrial processes would just spring up overnight. They will then be feasible.

Griswold: How could atomic power be useful in barren lands—like Arabia or the Australian desert?

Palevsky: Why, in making fertilizer. You need power to make fertilizer.

Griswold: Yes, but what about water? Water would still be the essential ingredient, wouldn't it?

Baker: If you have the energy, you can demineralize sea water. If you have the energy, you can also pump it as far

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as you like, if you're willing to pay for it.

It's not a matter of discovering any fundamentally new principle. It's a matter of getting the science, the technology and the economics together.

Palevsky: Even in those desert regions, I think if you go down far enough, you get water. It just happens to be uneconomical to pump it now. But cheap power from atomic energy would easily make the pumping job feasible.

Griswold: Have we yet come up with any practical atomic explosive for changing the course of rivers, or for changing the course of hurricanes or tornadoes?

Mrs. Baker: Well, you'd pollute your rivers, for one thing.

Palevsky: And if you dropped an atomic bomb into the eye of a tornado, you'd scatter lethal radioactivity all over the countryside.

Baker: The Eastman Kodak Company would certainly be unhappy. *[Laughter.]*

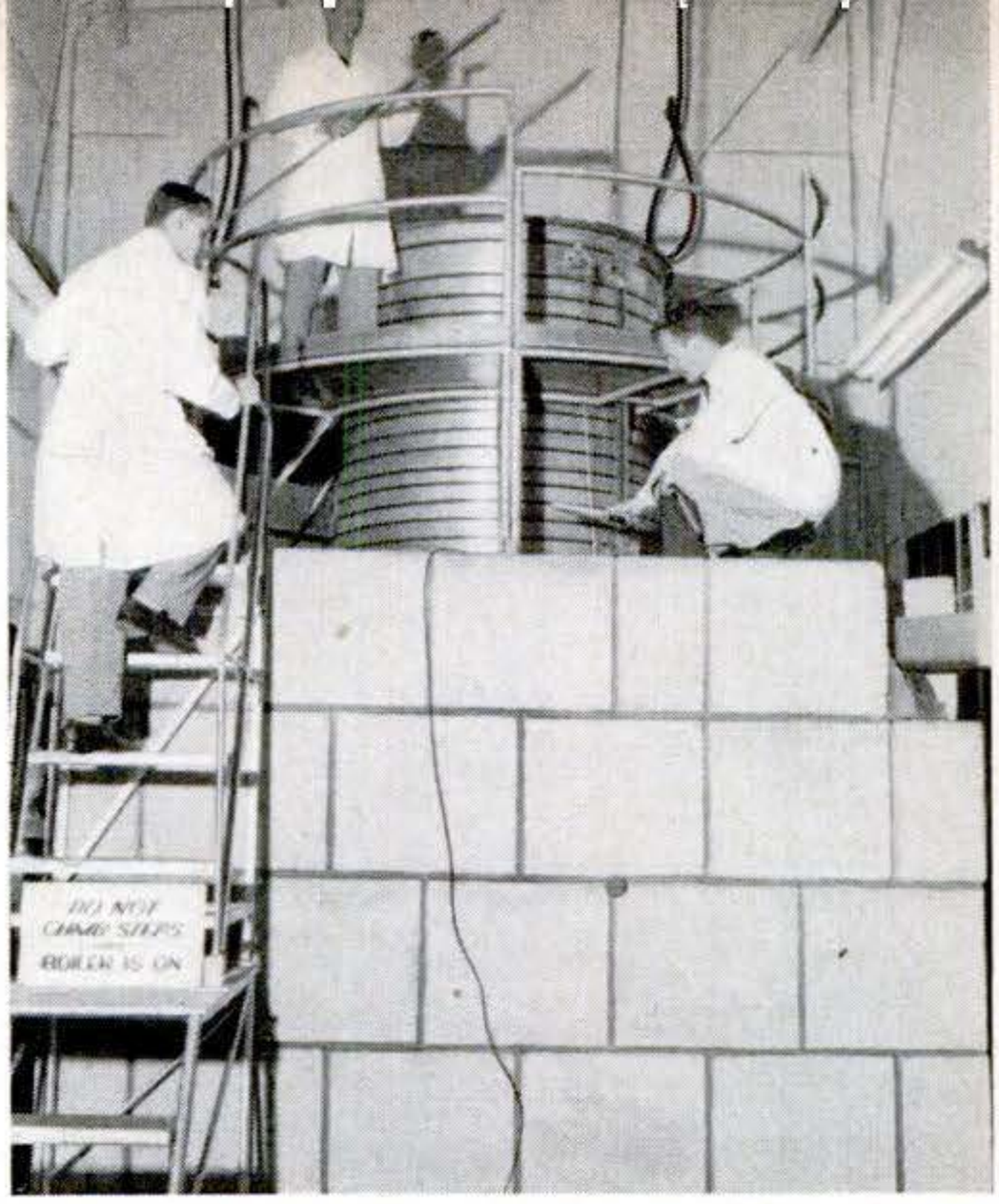
Griswold: If the proposed atomic pool is going to exist in several different places, scattered throughout the world, how can it feasibly be guarded?

Higinbotham: First, is it worth guarding? Probably all the material contemplated for the pool will not be enough to make a single atomic bomb. And when the atomic bombs in the world already are counted in the hundreds or the thousands, material that could possibly make one more is not really important.

Griswold: Isn't it true that, with the right kind of reactor and the necessary raw material, in the course of making atomic power you also make plutonium?

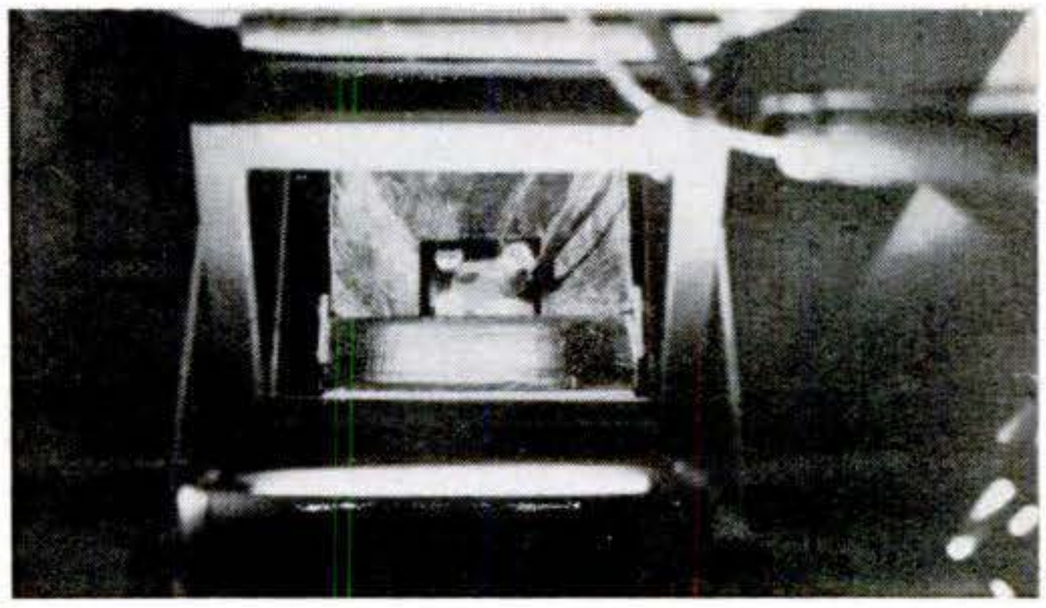
Higinbotham: Yes, but it isn't until you have really big power plants that the amount of plutonium you are going to produce in a year will be significant.

Baker: Besides, in order to make this plutonium useful, you would have to run your plant in a particular way and it would involve certainly an equivalent plant to extract the plutonium. In other words, if you went and looked at the power plant, you wouldn't need to be a detective to tell if people were milking explosive plutonium from it.



THIS BABY REACTOR, with power of less than a single watt, is valuable for research but doesn't produce fissionable materials. It indicates growing flexibility of reactor size.

Griswold: If you were a nation that had borrowed uranium from, say, South Africa, and now had plutonium, where would you send the plutonium?



PEEP INTO A PILE at Oak Ridge is provided by looking into an overhead mirror, which guides an operator with hand tongs when he is ready to withdraw radioactive samples.

Baker: Send some back to South Africa, so that they can start *their* power plant.

That is, I would think that if the pool delivers uranium to somebody and they use it in a power plant, and use the power for their benefit, then the plutonium which they make incidentally should, of a certainty, belong to the pool and might be sent to help make a quart of milk for every Hottentot, or whatever

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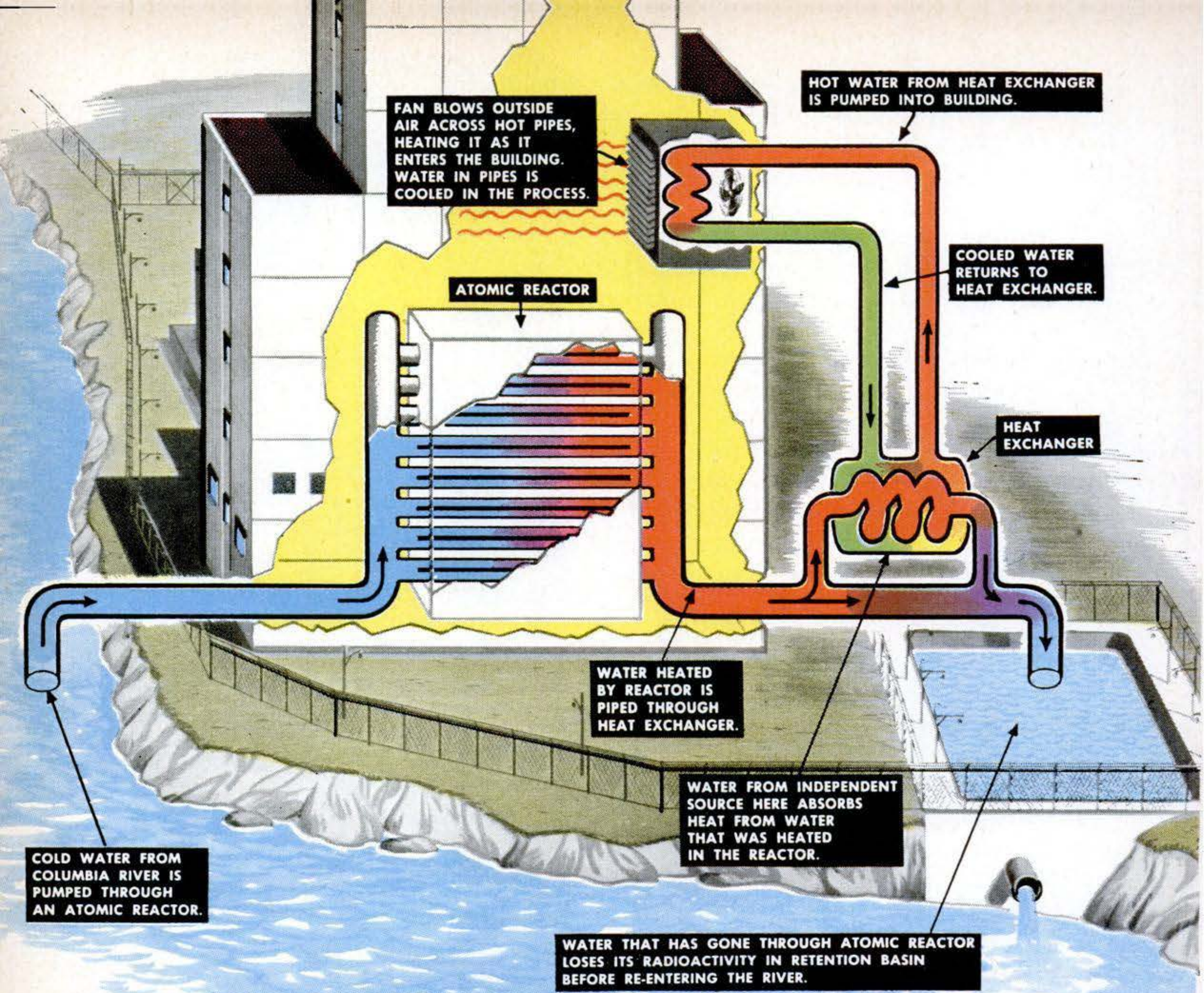

HEATING BUILDINGS BY NUCLEAR FISSION will soon be done this way at the AEC's Hanford, Wash., plutonium plant. The tremendous heat generated in making plutonium would otherwise go to waste. The British pioneered this practical process.

else seems to be a worthy undertaking.

Mrs. Baker: Essentially, then, you could just rent the material, and then pay it back to the lender.

Higinbotham: It would be ideal if, when we allow another nation to take from the international pool certain material that had been allocated to us, we would also permit that nation's scientists to visit our laboratories, see our reactors, learn our techniques. Some of our scientists, too, would be expected to go to those countries and help them get started on their research—let them in on our know-how.

Williams: The information is fully as important as the materials, if not more so.

Higinbotham: This proposal of Eisenhower's really will be something that will be awfully hard for the Russians to turn down.

If you can get a start at talking on a practical level about these problems of the exchange of information and people and cooperation, there will certainly be an entirely different atmosphere from the one we're presently living in.

And one could hope that out of these discussions would come something at least as attractive as the Eisenhower proposal, and that this would be the beginning of breaking down the iron curtains that exist not only around Russia but around a good many of the rest of us, too. END

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HUNTING FOR DETAILS of an old car, Hornung pauses in mid-drawing to check catalogues, ads and specification lists.

He's the Audubon of the Automobile

C. P. Hornung stalks the rare and early birds of motordom and draws their portraits.

By George H. Waltz Jr.

AMERICANS scarcely knew one bird from another, unless they were edible, until John James Audubon painted their portraits, exact to the tiniest speckled feather.

Now a whole generation of car-loving Americans is getting acquainted with the gaudy and gleaming automobiles of the past—some of them very rare birds indeed—because a modern Audubon is drawing painstakingly authentic pictures of them.

Clarence P. Hornung of New York City, whose gallery of America's earliest cars already includes 75 portraits, didn't take up the hobby that has become his booming business until 1949. Until then he was an industrial artist and specialist in creating trademarks and package designs.

One Saturday in September, 1949, Hornung happened for the first time to visit James Melton's Museum of Antique Cars at Norwalk, Conn. The quaint lines and vivid colors of the old vehicles fascinated him. As an artist, he was amazed

Oldsmobile *introduced this alluring runabout in 1903 and called it "the best thing on wheels." Extra seats, top or delivery box could be "instantly attached."*

Drawings Copyright 1951, 1952, 1953 by Clarence P. Hornung

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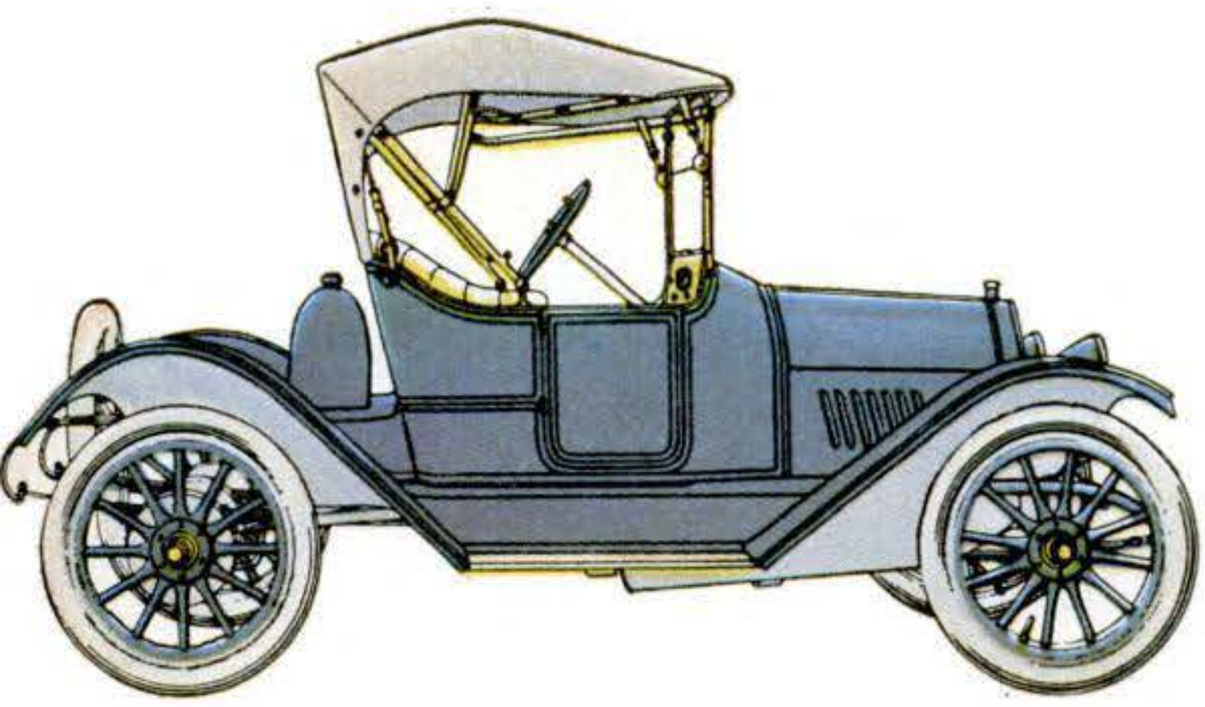
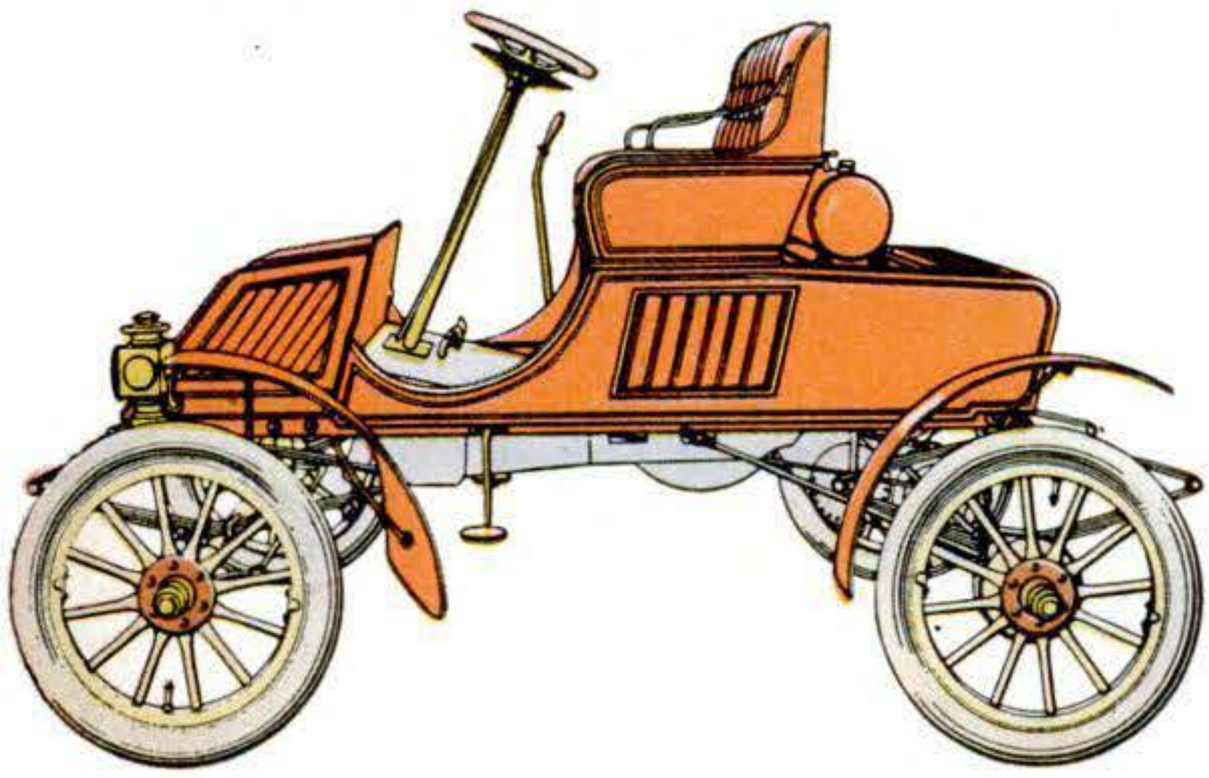
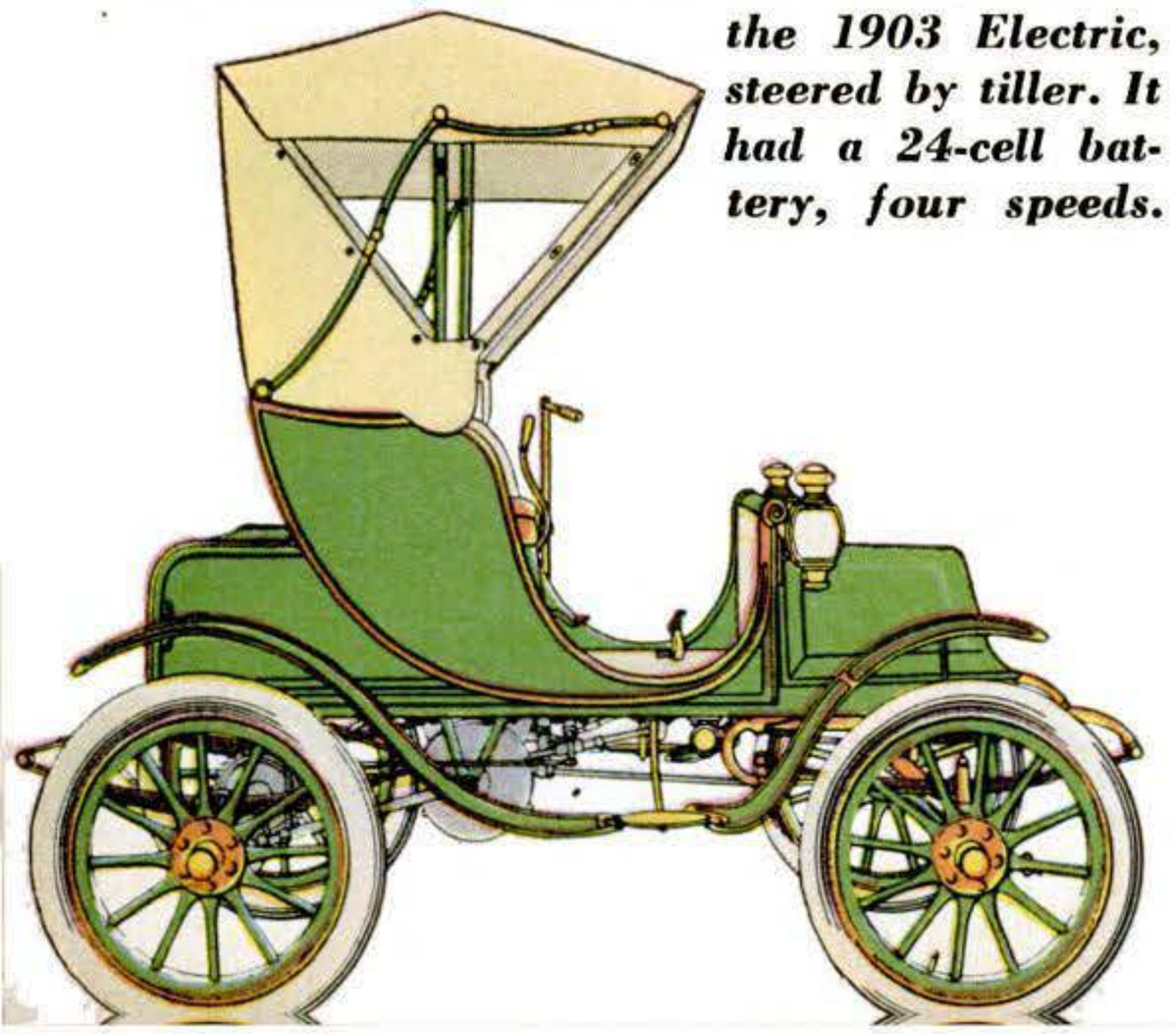


Chevrolet *began making cars in 1912 and turned out 2,999 that year. In 1914 it produced the Royal Mail (above), a 24-horsepower, four-cylinder job that is called the modern Chevy's true ancestor.*



Nash *dates its Ramblers back to 1900. This was the 1902 model. Actually, Ramblers were made by the Thomas B. Jeffery Co. until 1917, the year after Charles W. Nash quit Buick and bought out Jeffery.*

Studebaker *had been renowned for 50 years as a maker of wagons and carriages when, in 1902, it entered the automotive field with an electric car. This was the 1903 Electric, steered by tiller. It had a 24-cell battery, four speeds.*



to find that no drawings or prints of them were available. No one up till then had ever made a pictorial history of the American automobile.

By the following Monday, Hornung had decided to create that history himself. He plunged into a program of research that in the following months took him to book shops, print dealers, catalogue collectors and old-time car salesmen. He gathered a mounting pile of flyblown catalogues, yellowed newspaper and magazine ads, specification lists and old photographs.

Soon he was armed with enough information to produce his first eight portraits: an 1877 Selden, an 1895 Duryea, an 1896 Ford, an 1898 Winton, an 1899 Packard, a 1902 Autocar, a 1903 Oldsmobile and a 1903 Cadillac. When colored prints of them had been run off, Hornung offered them for sale in a few small ads in New York newspapers.

The response was astonishing. Hundreds of orders cascaded upon his studio. In two months he sold 2,000 sets. Suddenly he was researcher, artist, publisher, mail-order clerk and shipping clerk all rolled into one.

The Auto Bug, the Izzer, the O-We-Go

Happily surrendering to the avid demands of old-car fans, Hornung went back to the "scrap" pile and the drawing board and began producing more portraits of the ancestors of today's automobiles. To date, 47 prints have been made from the 75 drawings he has completed. He plans to finish 25 additional drawings by 1955.

Audubon, wandering in search of birdlife, encountered such feathered eccentrics as White-Eyed Flycatchers and Tell-Tale Godwits. Hornung, in his entertaining research, has happened upon the Auto Bug, the Izzer, the O-We-Go, the Static Super, the Quick and the Zip.

Hornung's "collector's prints" have been exhibited in museums and libraries all over the U.S. Reproductions of his drawings decorate glassware, lacquered trays, coasters, Christmas cards—even silk scarves. END

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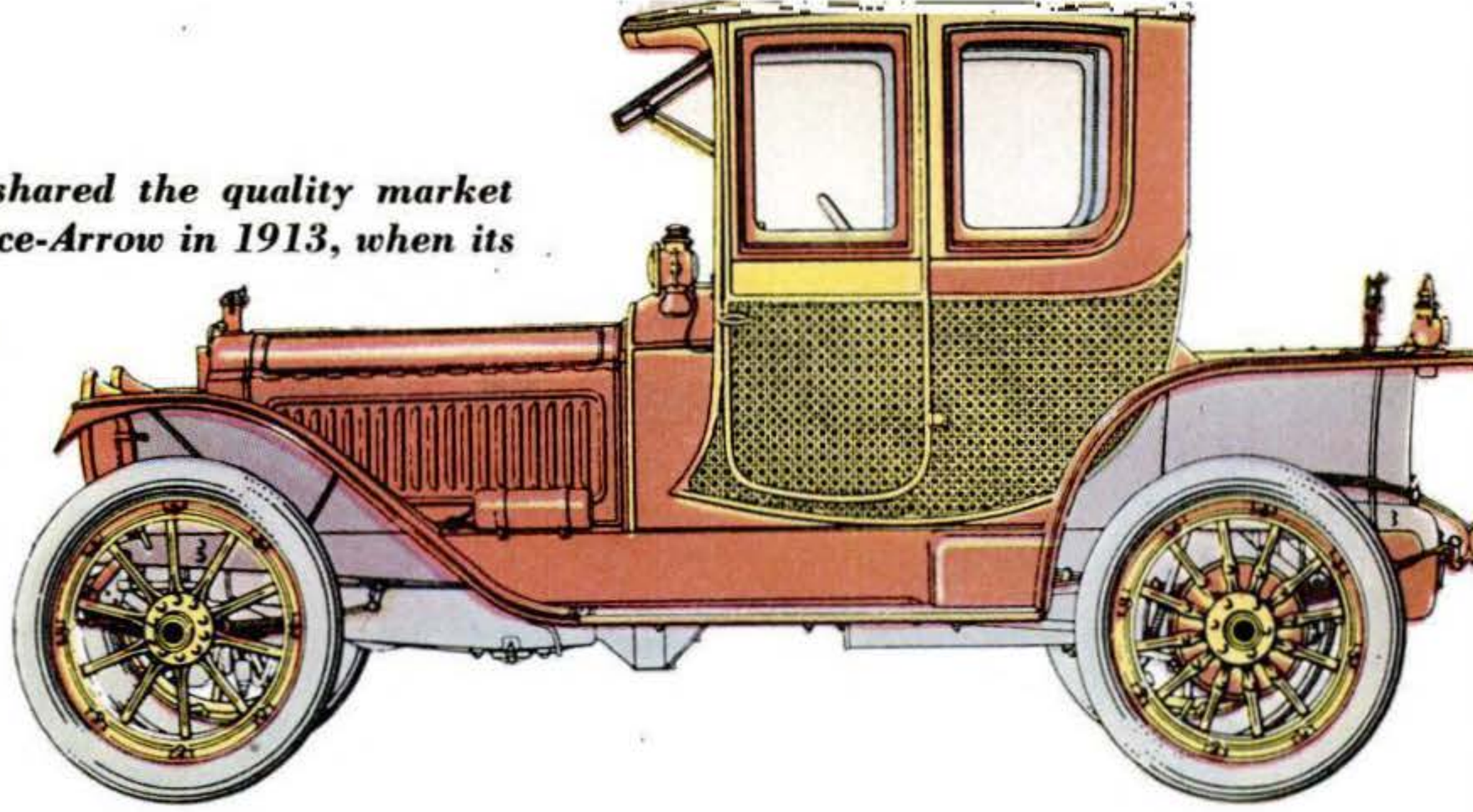
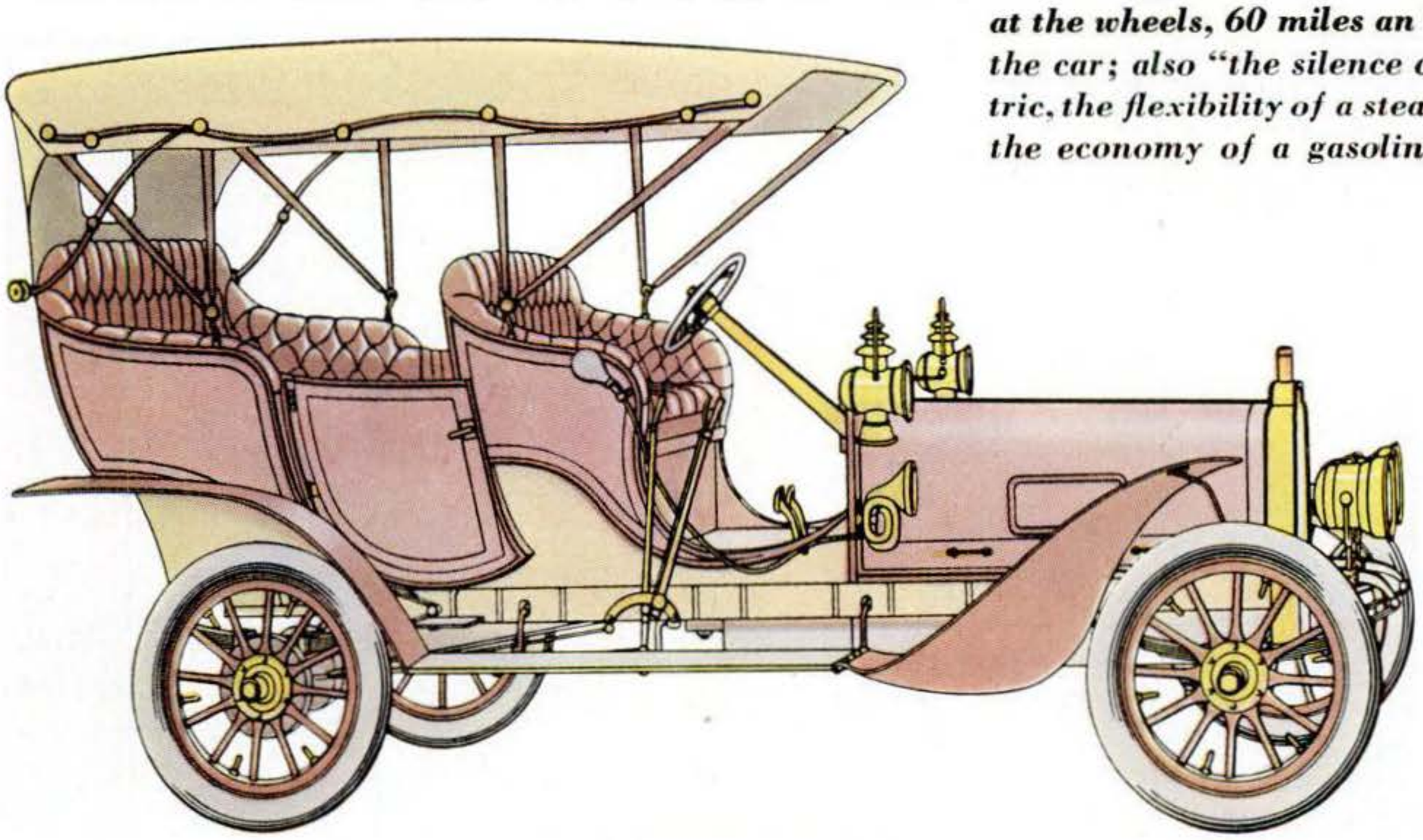
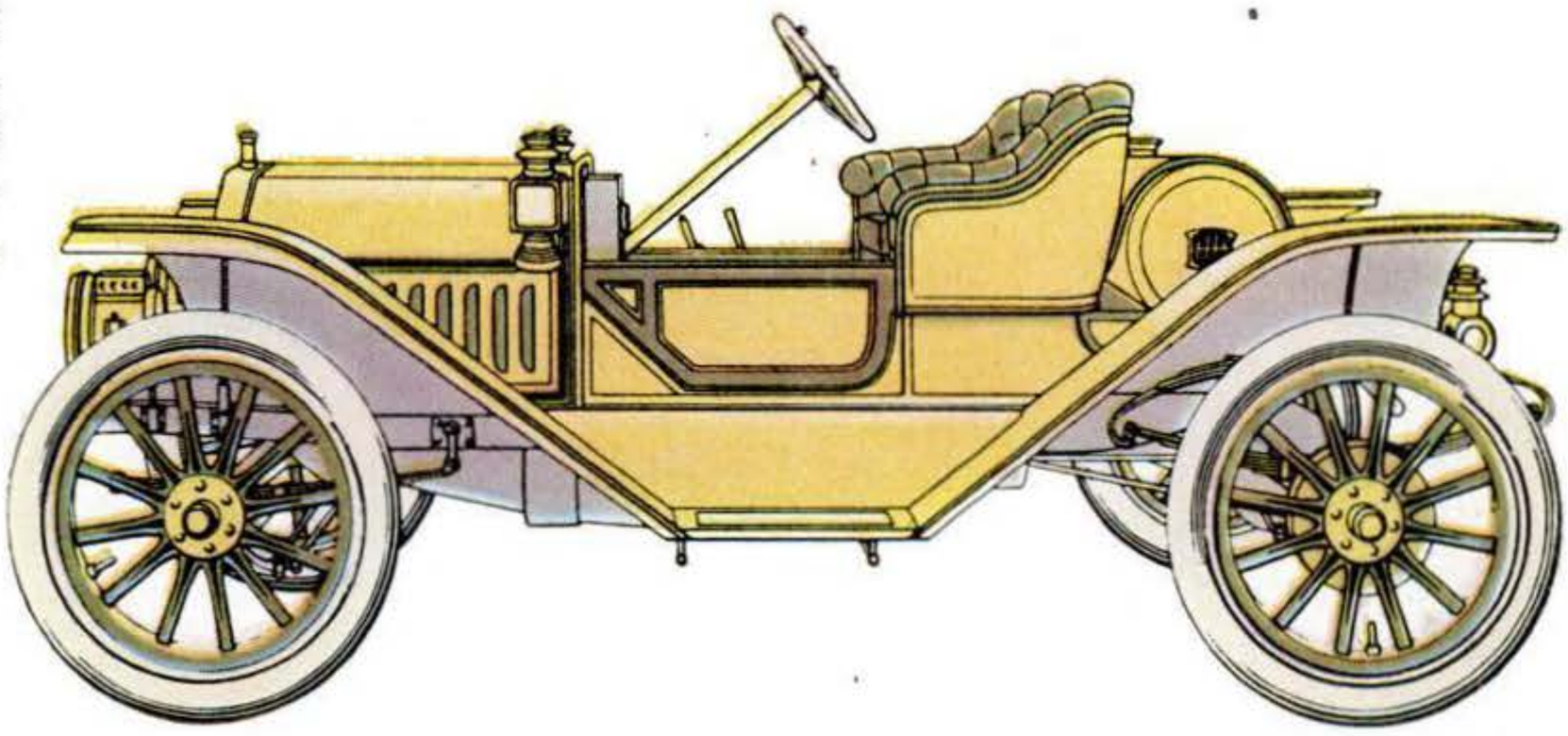
Packard *shared the quality market with Peerless and Pierce-Arrow in 1913, when its Model "48" (right) was introduced. The car had a six-cylinder, 48-horsepower engine. The famed "twin six" came out next year.*



Ford *made a try for the luxury market, in addition to the low-priced field, in 1906, when the company produced its six-cylinder Model "K" (below). Price of the car was $2,500, later upped to $2,800 ($3,000 fully equipped). Ford's advertising claimed "40 horsepower at the wheels, 60 miles an hour" for the car; also "the silence of an electric, the flexibility of a steam engine, the economy of a gasoline motor."*



Buick *brought out this "26" Roadster in 1911, when runabouts and roadsters, like convertibles today, were the last word in sportiness. The 2,100-pound "26," priced at $1,050, was one of the most popular Buicks that year. It had a 35-horsepower, four-cylinder, valve-in-head engine and a 100-inch wheelbase. A few Buick "26" roadsters, tenderly cared for by antique-car fans, are still running.*



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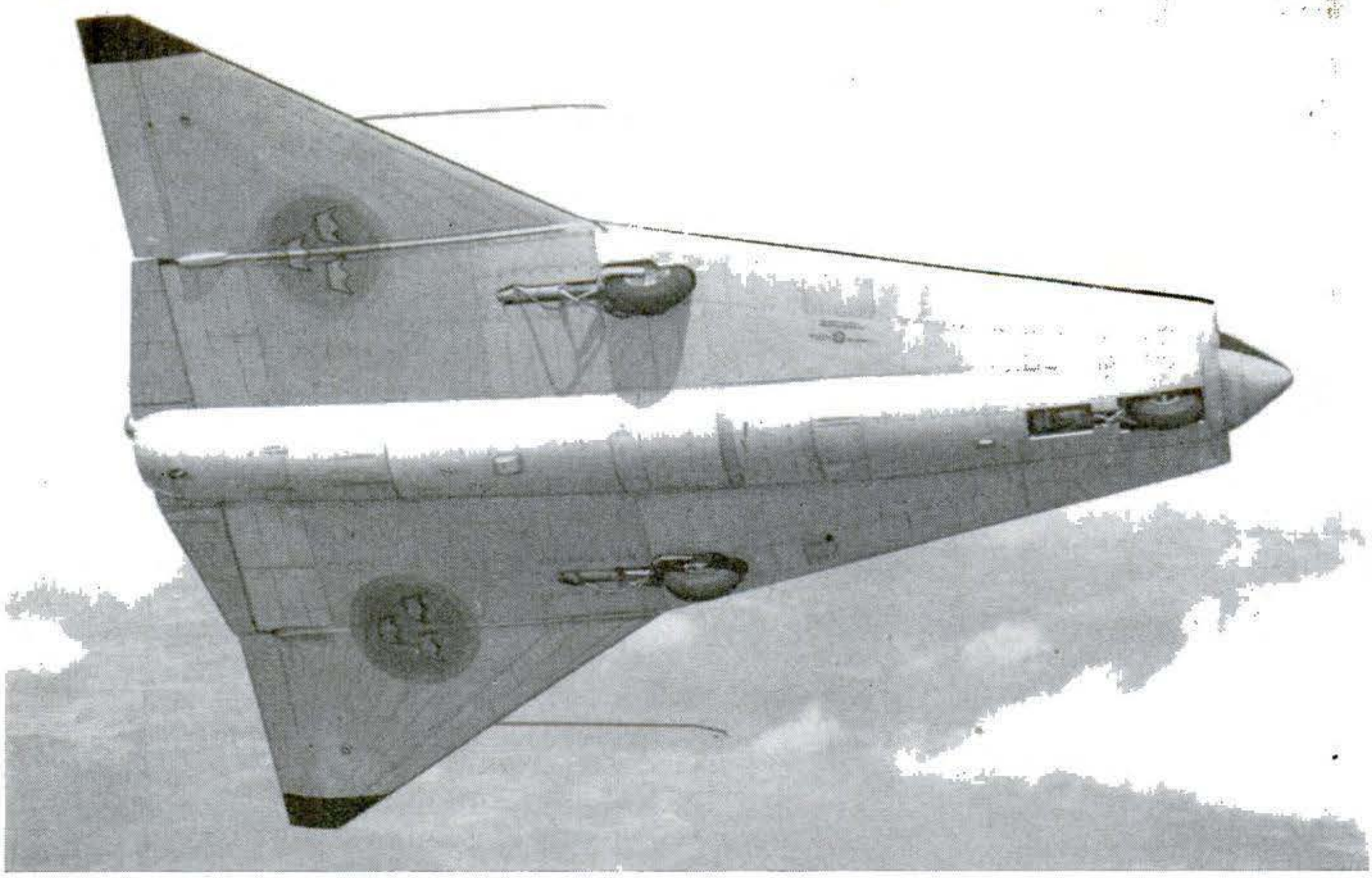


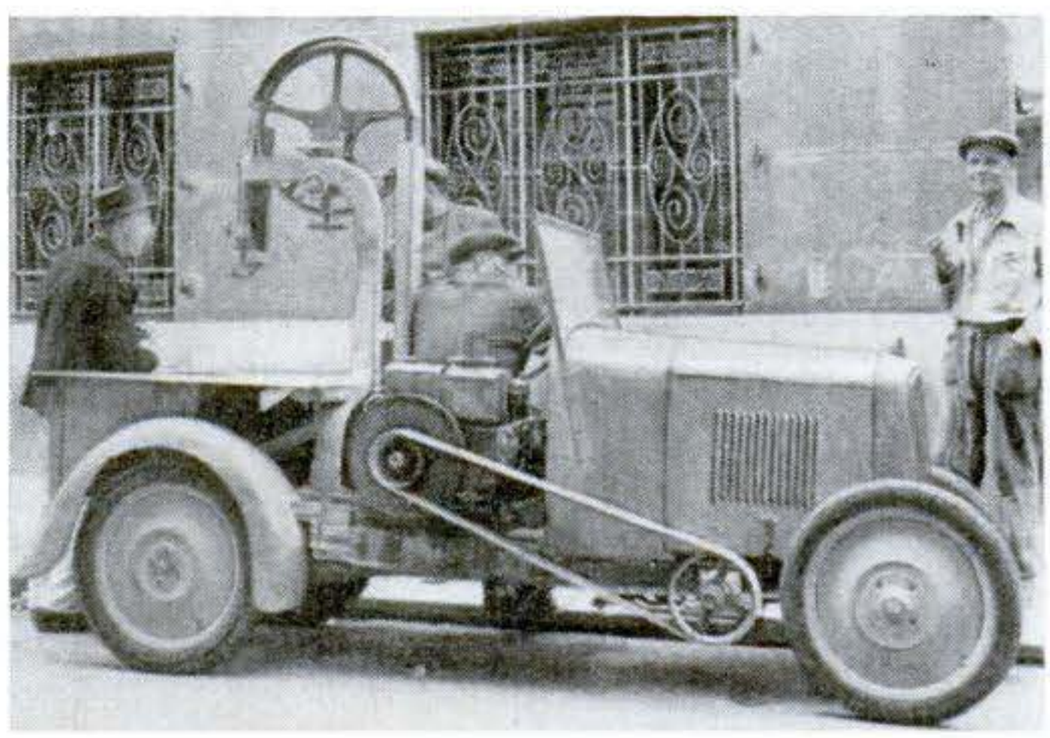
Swedish Research Plane Uses Unusual "Double-Delta" Wing

THIS underbelly shot of the Swedish Saab-210 gives you a good view of its odd "double-delta" wing. Already put through 400 successful test flights, the research plane foreshadows the design of future Saab fighters. Since the picture above was taken by Esso photographers, a new nose section has been fitted to squeeze more speed from the turbojet power plant—an Armstrong Siddeley Adder.

British Make Plastic Scooter

THE new British scooter above is made of laminated glass fiber. A telescoping hand lever starts the single-cylinder, two-stroke engine, and the driver shifts gears with his feet. The scooter can do 40 m.p.h. and travel 120 miles on a gallon of gas.

▶▶▶Chipmunks get credit for planting 17,000 trees an acre in the western pine area. They bury seeds, forget to dig them up.



Carpentry Shop Rolls to Job

THE strange vehicle above is a mobile tool shop used by itinerant carpenters in Yugoslavia. As the men find work driving from door to door, they cut lumber on the spot with an elaborate system of gears and belts providing power for saws and drills.

▶▶▶The shock-resisting instrument lamps in rough-riding tanks owe part of their reliability to pinball machines: Westinghouse engineers first solved the problem when they designed extra-sturdy bulbs to withstand the wallops players give the pinball games.

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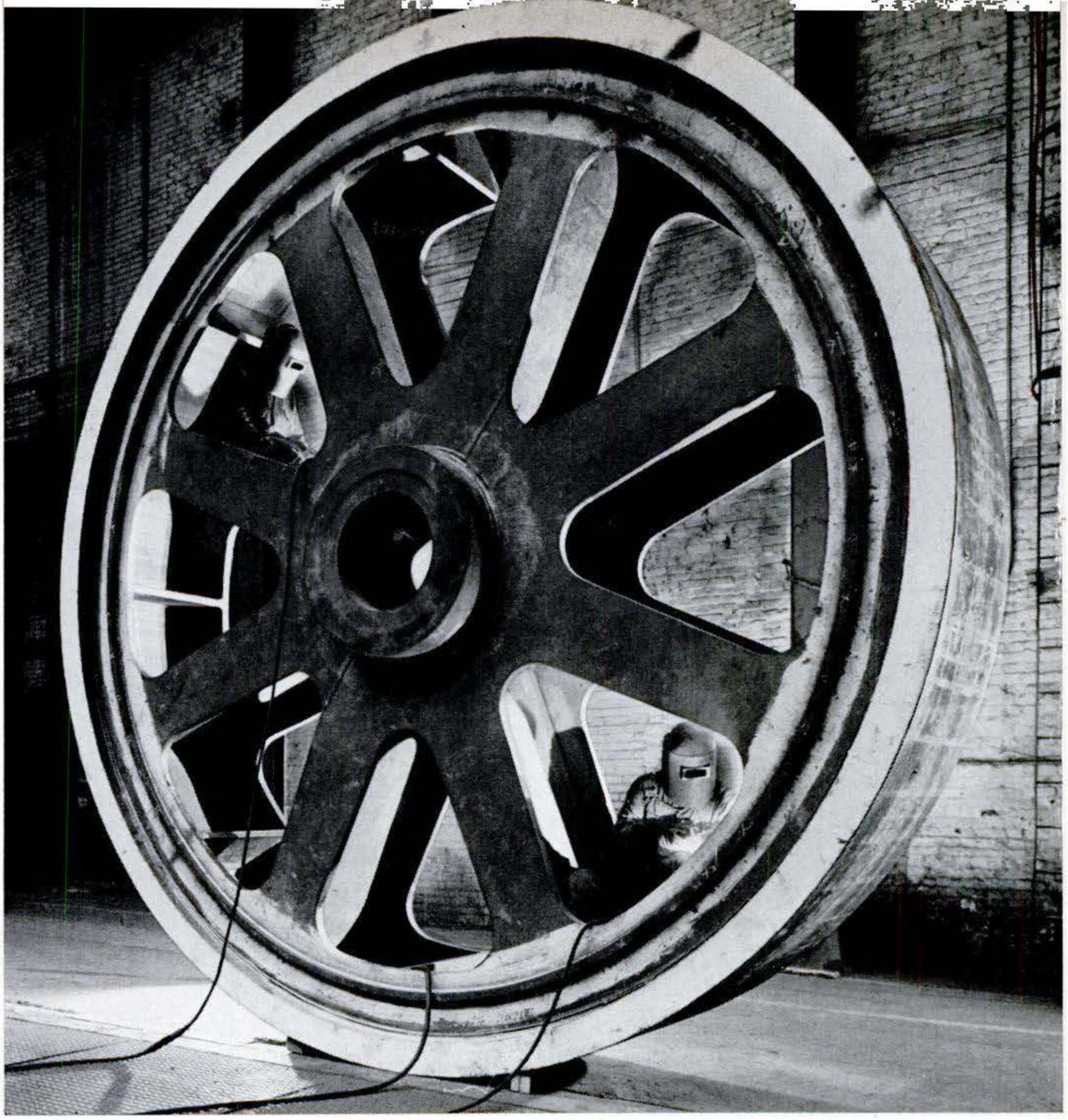

37-Ton Pulley Wheel Will Raise and Lower New Bridge

THIS is one of four giant sheaves for a vertical-lift bridge that will span New York's East River to give access to a hospital on Welfare Island. Cables passing over the sheaves, set in pairs high in the bridge towers, will carry two 515-ton counterweights. Bethlehem Steel workers forged, rolled and welded the 37-ton wheels.

They Say Now.....

HENRY B. DU PONT, VICE-PRESIDENT, THE DU PONT CO.: *"To create a useful product out of material which was once thrown away is the essence of technology."*

ERNEST A. HOOTON, HARVARD ANTHROPOLOGIST: *"Civilized man is a partially domesticated animal living in an artificial environment."*

REPORT OF THE NATIONAL MANPOWER COUNCIL: *"For every high-school graduate who eventually earns a doctoral degree, there are 25 others who have the intellectual ability to achieve that degree but do not."*

DAVID F. AUSTIN, U.S. STEEL: *"A friend of mine who fancies himself a humorist explained that American enterprise is the art of making toeless shoes a fashion instead of a calamity. There's a bit more to it than that, however."*

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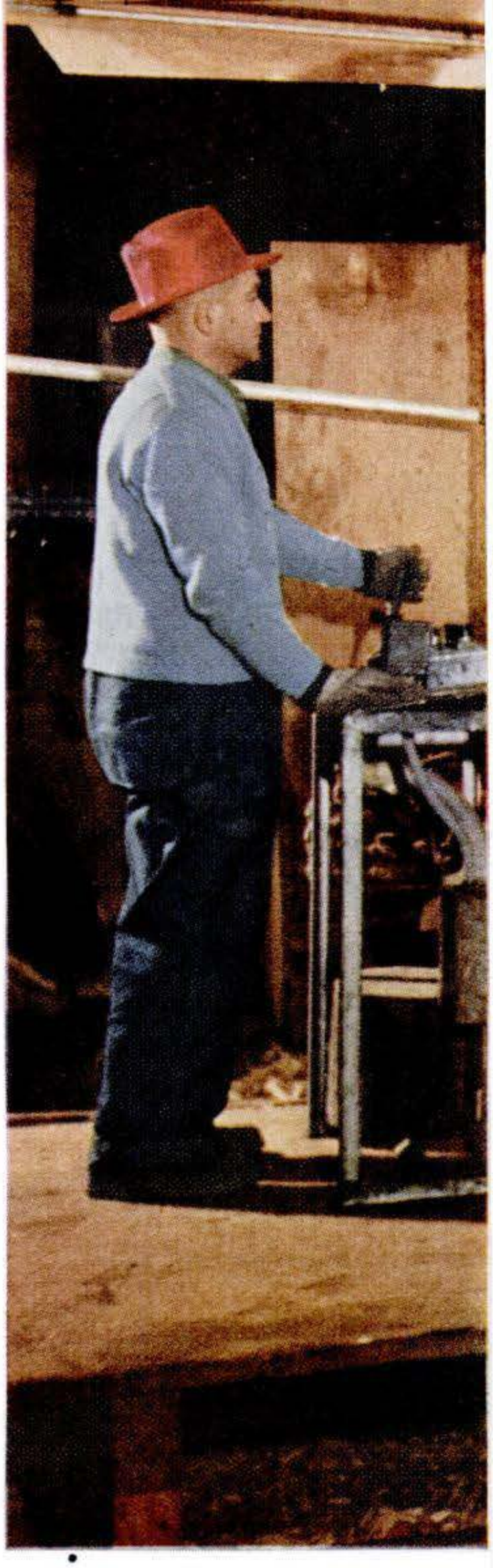
Logs float into mill that will turn them into plywood.

How Plywood Is Made

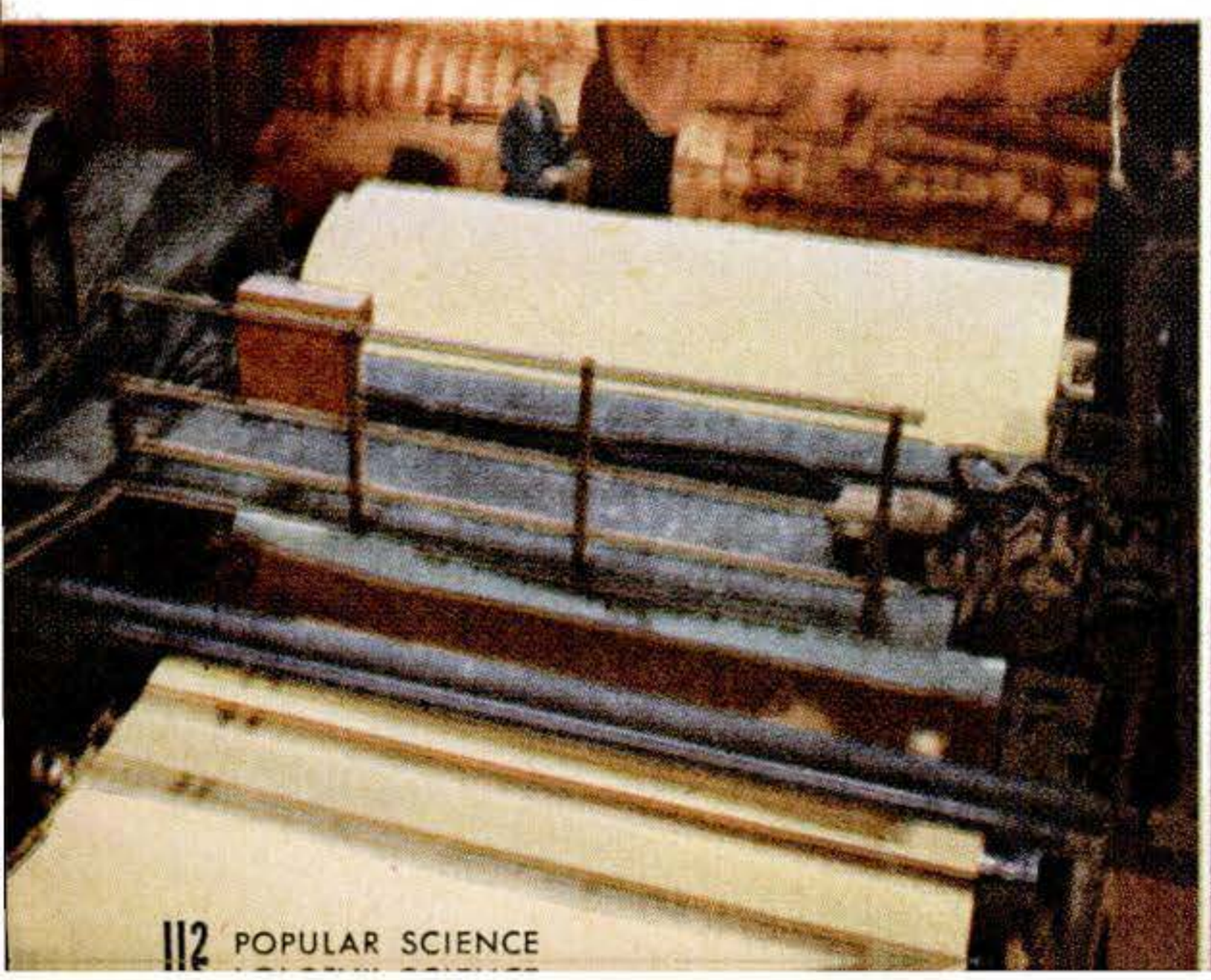
THERE probably isn't a home in the U. S. without plywood, either in the structure itself or in furniture. On the farm, plywood goes into silos, barns and hog houses. It goes to sea in ocean liners, small pleasure craft, tuna clippers and tugboats. It rides the rails as new, light boxcars. These pictures, taken in one of the 85 factories of the Douglas Fir Plywood Assn., show how it's made.

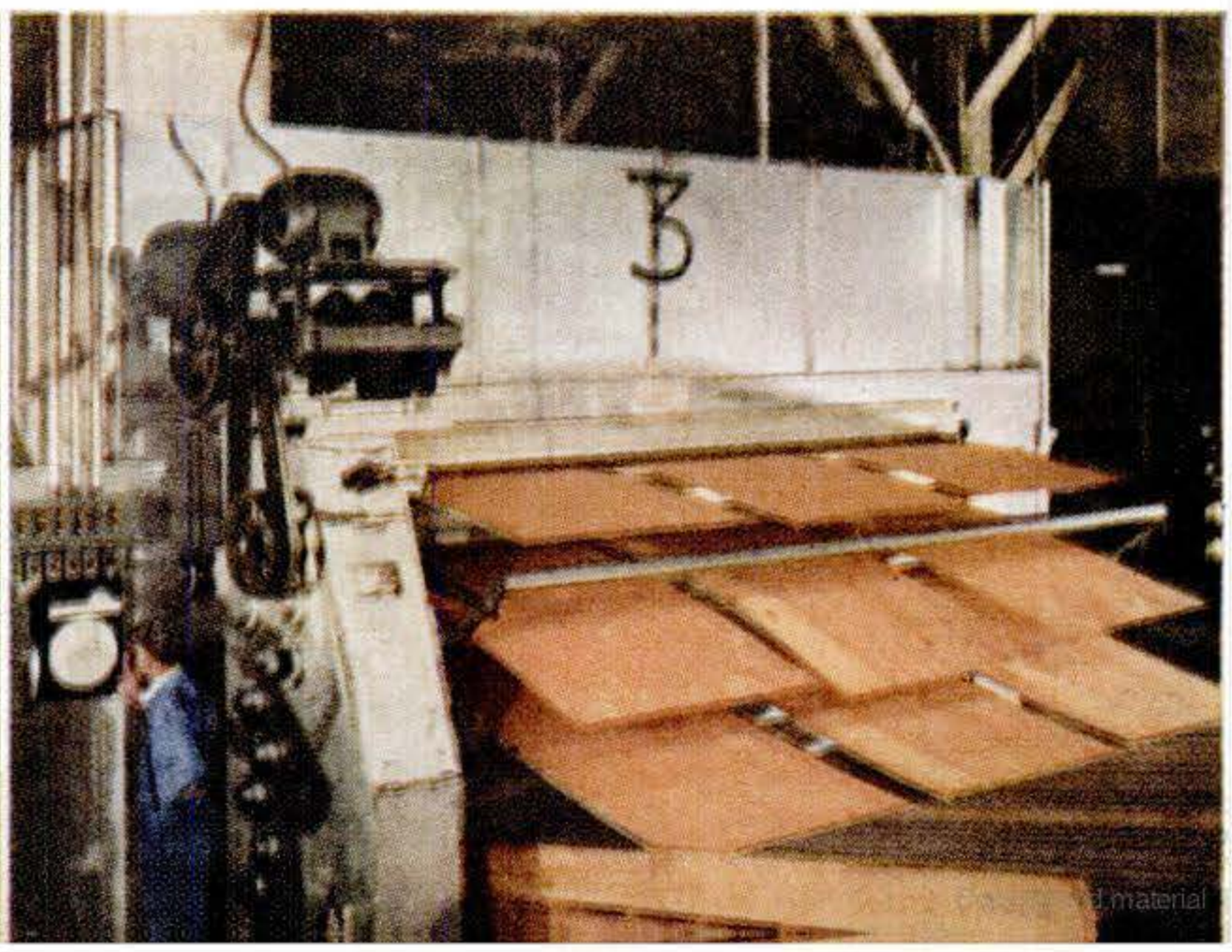


1 BARK is quickly stripped from log as it is whirled at high speed against gearlike cutting head of giant lathe. Select fir logs, usually a thick three feet or more in diameter, come from the Cascade Mountains of Washington, Oregon and California.

2 BARK-STRIPPED LOG, called a peeler, goes to another big lathe that shaves off ribbons of wood from 1/10″ to 3/16″ thick. Three peelers like the one below, eight feet long and four feet in diameter, supply enough panels for a small plywood house.

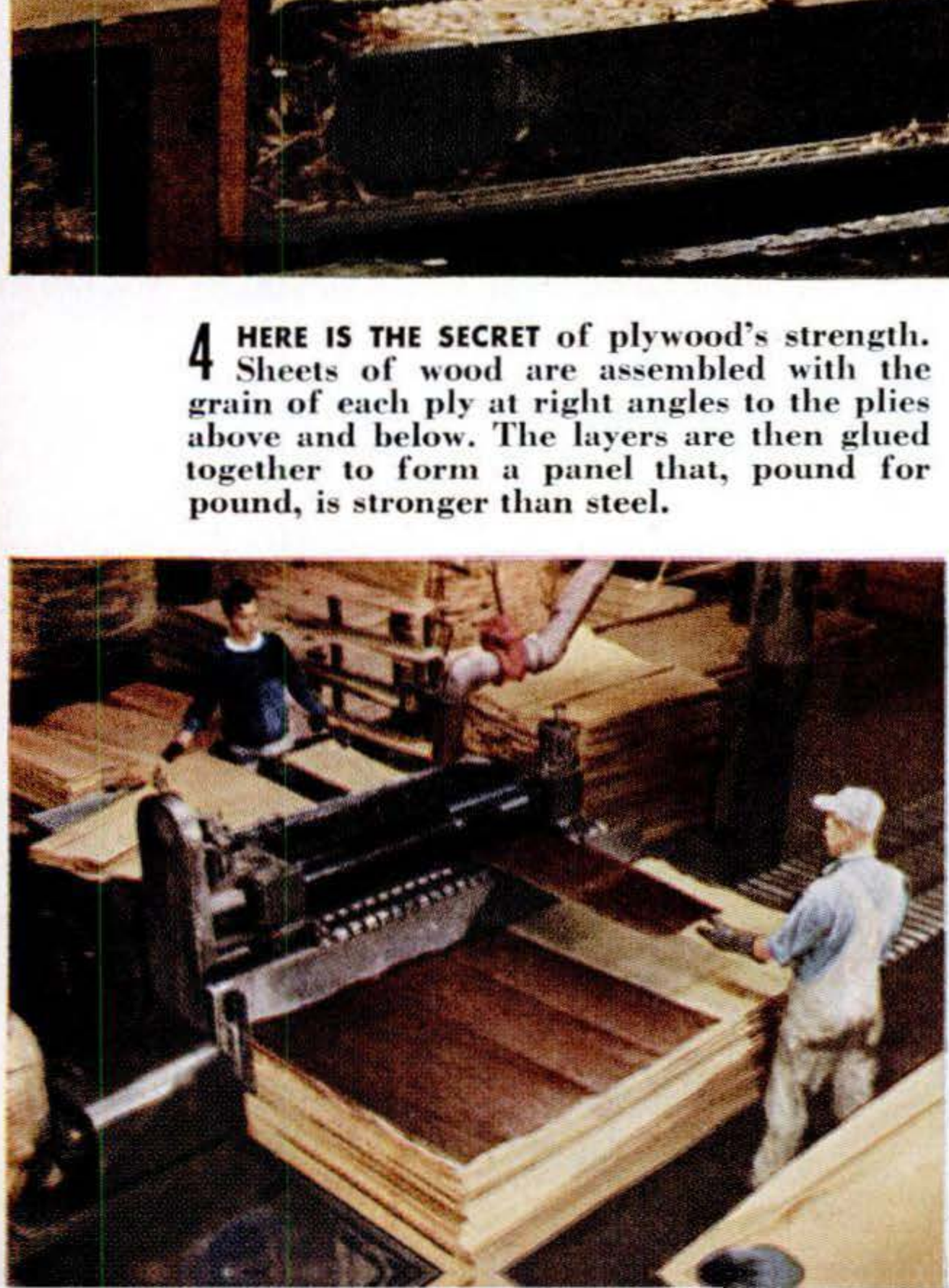
3 GETTING THE MOISTURE out of the thin strips of wood is next step. The wood ribbons travel through 100-foot-long ovens set at a temperature of 350 degrees. Here the strips are shown coming out after moisture has been reduced to less than four percent.

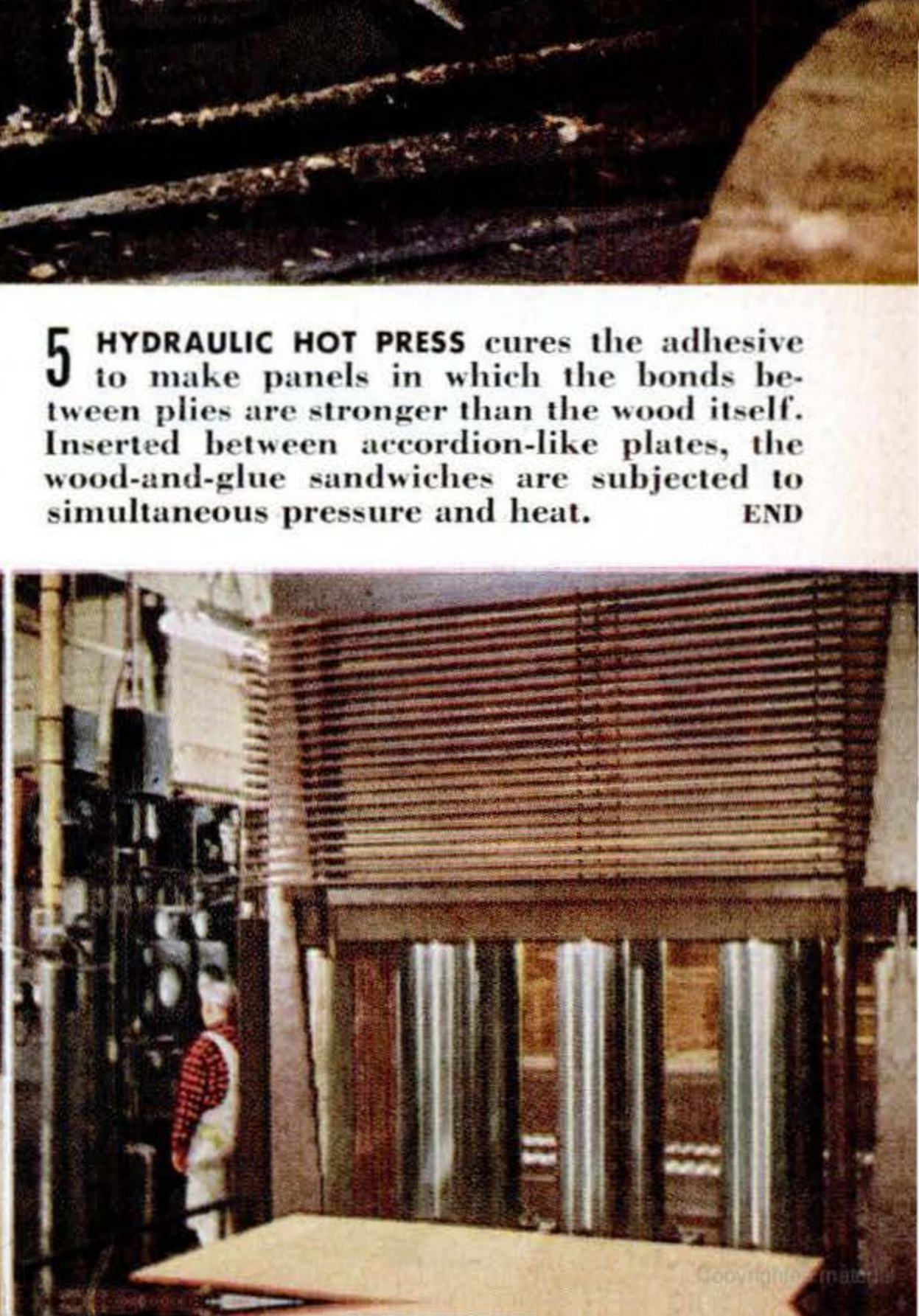




4 HERE IS THE SECRET of plywood's strength. Sheets of wood are assembled with the grain of each ply at right angles to the plies above and below. The layers are then glued together to form a panel that, pound for pound, is stronger than steel.

5 HYDRAULIC HOT PRESS cures the adhesive to make panels in which the bonds between plies are stronger than the wood itself. Inserted between accordion-like plates, the wood-and-glue sandwiches are subjected to simultaneous pressure and heat. END

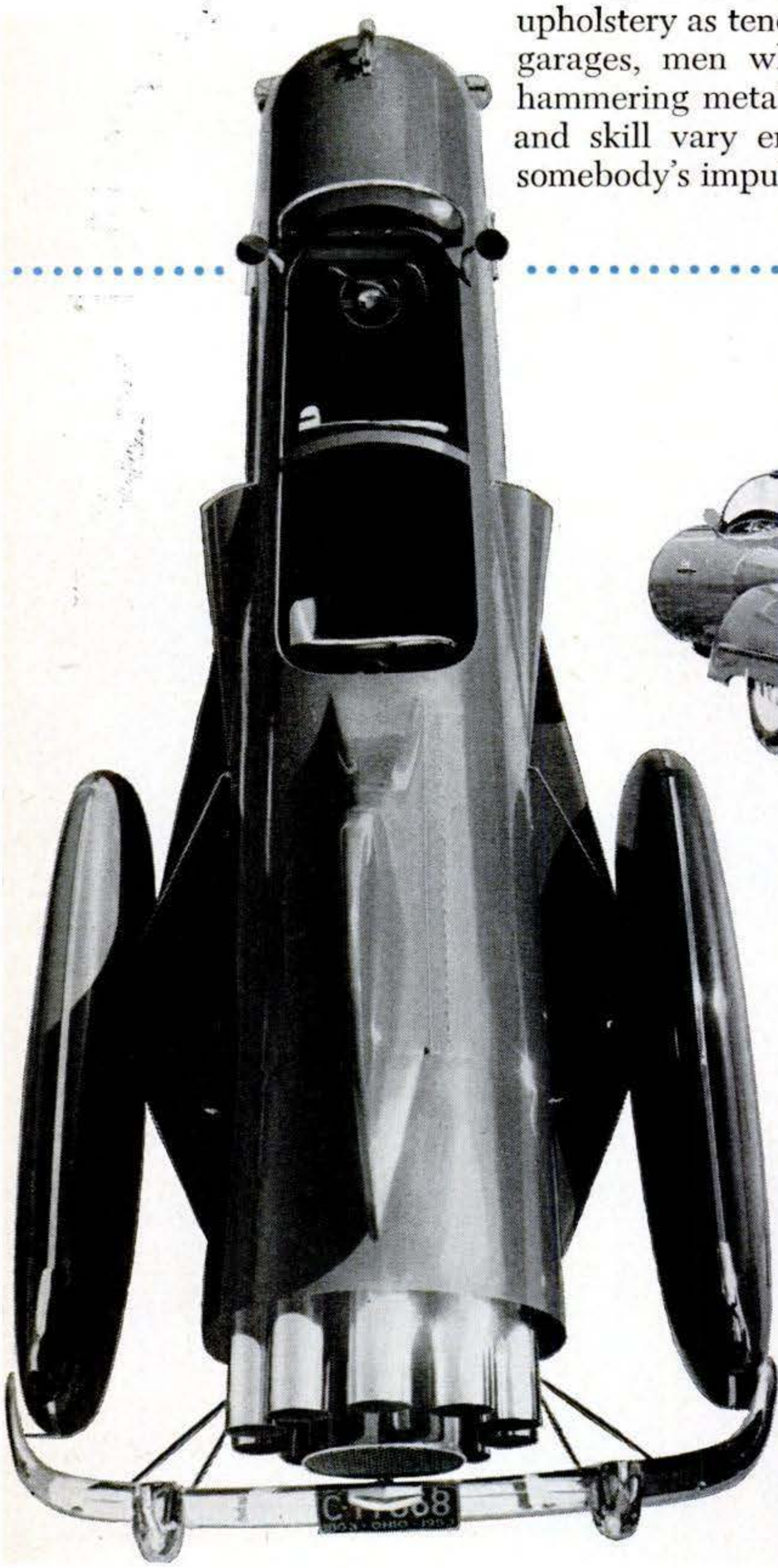


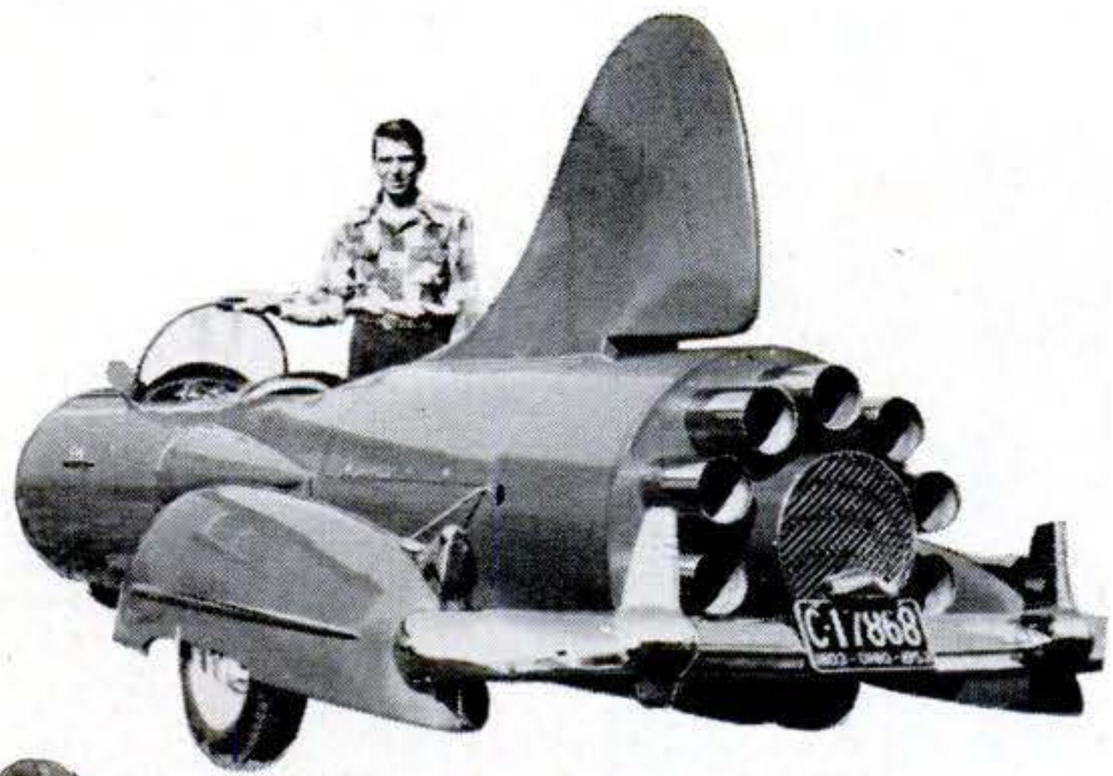


Back-Yard Builders Turn Out

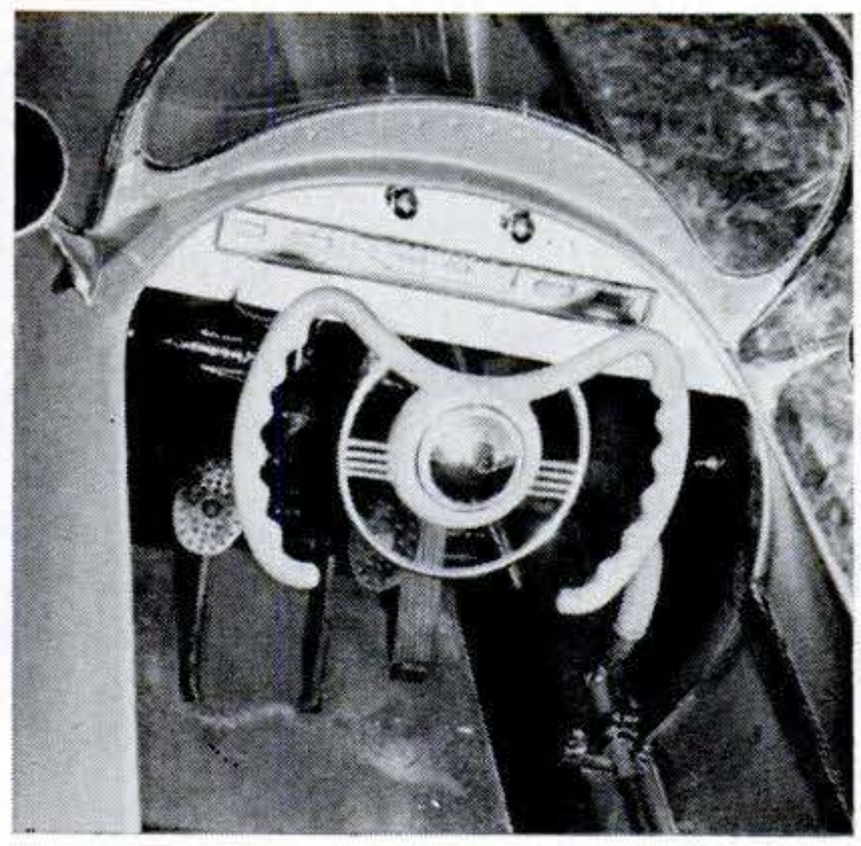
Weird and Wonderful

DIG those beasts! And those home-brewed wagons with chromed jet-assist, or with magenta upholstery as tender as a baby. In thousands of U.S. garages, men who want something different are hammering metal into new shapes. The inspiration and skill vary enormously, but every car mirrors somebody's impulse to create something new.





TRICYCLE built by refrigerator technician Stanley Eakin of Grove City, Ohio, is called the Comet, and painted a brilliant scarlet. Eakin spent spare time for six years building the 1,800-pound car, which tops 90 m.p.h. with a 60-hp. V-8 engine. The two scoops at the waist ventilate the rear-mounted engine, air being discharged via 10 tailpipes. In cockpit below, that lever at right works the remote shifting linkage.



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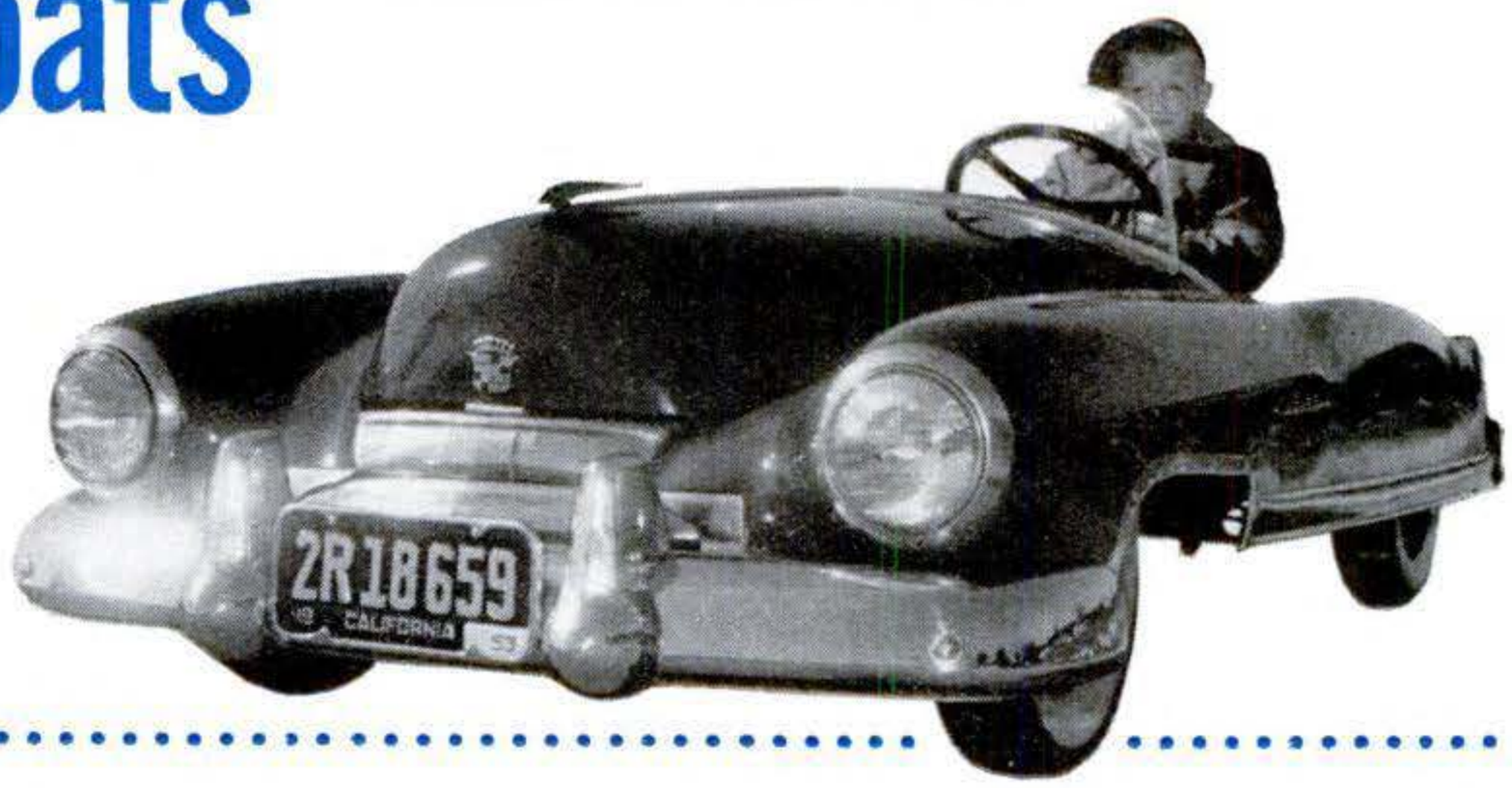
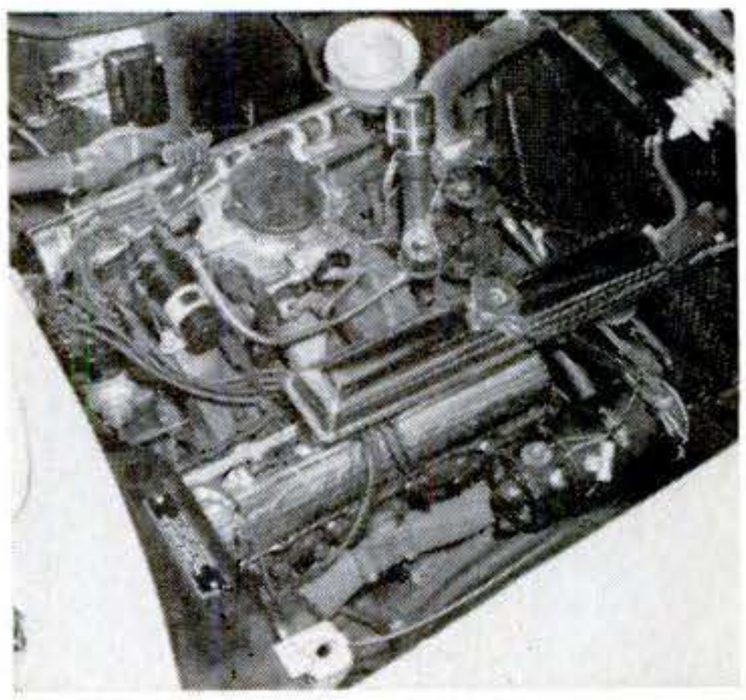
MINIATURE MILL in this small Cad began life in a '32 Austin. But it's got plenty of muscle for its present job—car hits 70.

Dreamboats

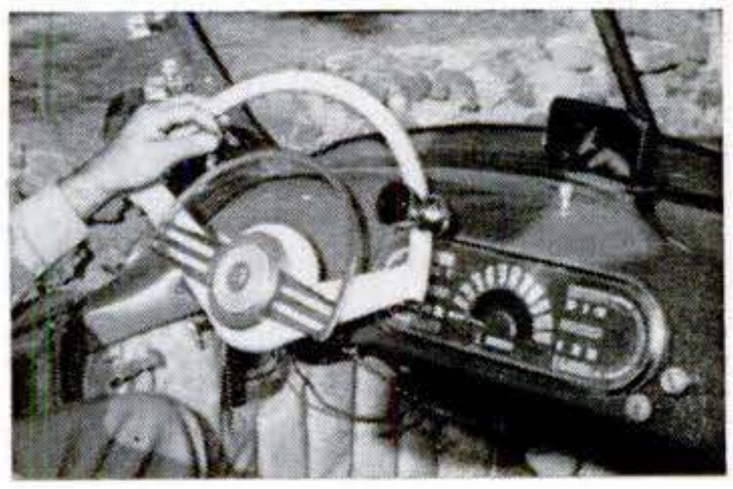
BITTY CADDY weighs less than 700 pounds, can almost run under a fence. Ralph Hartley of Hollywood built stainless-steel body on a cut-down Austin chassis. Hartley added lush touches: vacuum boosted clutch, power brakes.

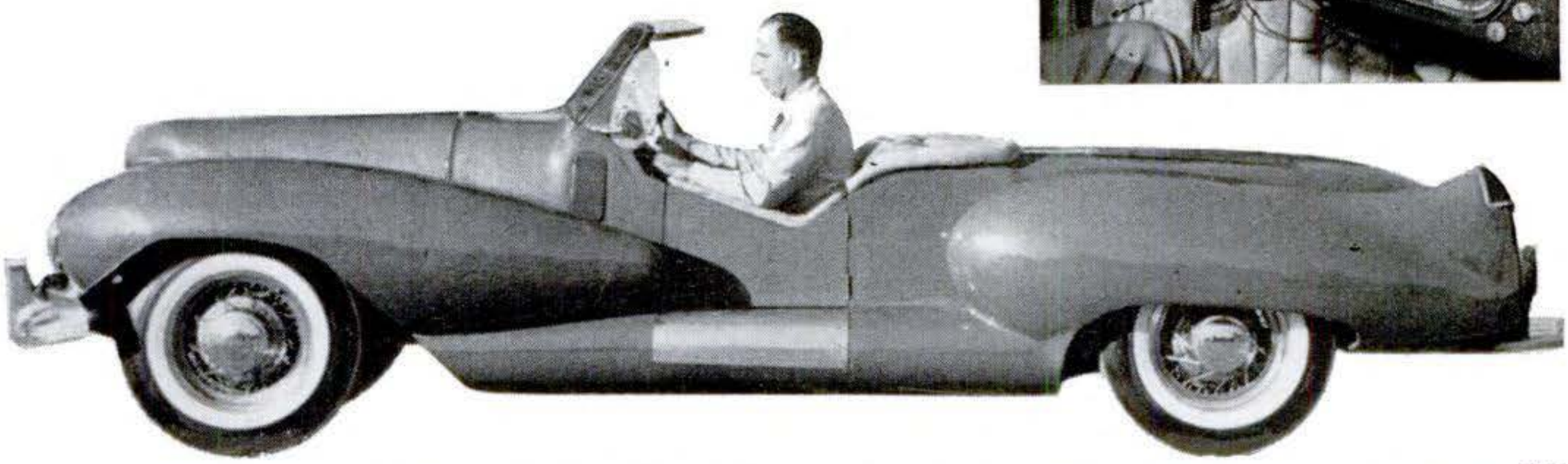




THIS HOT HYBRID is a crossbreed of two GM divisions. Starting with a Corvette with a jazzed-up Chevvy engine, Bill Frick, Long Island mechanic, spent 200 man-hours putting in a Cadillac plant. Car weighs 75 pounds less than before, has solid valve lifters and manual shift in place of Hydra-Matic. It now belongs to R. Rutherford of West Palm Beach.

MANY TANKS, five to be exact, went into this bright red roadster. Four interceptor-plane drop tanks were reworked for the fenders; a bomber tank made the body. Owner M. T. Avila Jr., Tulare, Calif., has laid out $8,200 on it so far. Car has a Ford frame, Chevvy grille, Olds instruments, and is 17 feet long. A Merc power plant makes it go.





Please turn the page for more dreamboats.

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MATE A MANTA RAY with a jet plane and this is what you get. Builders V. F. Antoine and G. K. Hire, of Whittier, Calif., work on guided missiles for a living. Snout is a chromed aluminum casting. Bumpers were fabricated from Hudson parts.

More Dreamboats

IF POP RIDES, he has to straddle the deck, but the three Tobias kids of Bakersfield, Calif., can shoehorn into the single seat. With a light, glass-fiber body, car has a curb weight of 250 pounds. But it can get up to 25 m.p.h. on its 1½-hp. air-cooled engine. Shortened Model T side rails made the chassis, and that fancy grillwork in front came from Buick radio grilles. Headlights were once Dodge parking lights. Car is less than two feet high.

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TRIPLE-TAILED CRAFT began as a '51 Studebaker sedan, was drastically rebuilt in 4,000 man-hours of labor. It has a V-8 engine and a curb weight of 1,000 pounds. The body is made of 14 glass-fiber subassemblies. Gas-tank opening is under center tail light.

MOSTLY A MERC, this car is prized possession of Don Pulford, Glendale, Calif., and won plaudits at recent Los Angeles Motorama. Front was lowered 4½ inches, wheel openings narrowed 2½ inches. Note the Cad "Dagmars" in front of grille.

HANDLELESS HUDSON, below, uses Mercury grille. Bob Stanclift, Long Beach, Calif., lowered it three inches, added buckskin leather trim and electric door latches.

FAST AND HANDSOME, this reworked '51 Olds has been timed at 135 m.p.h. at Bonneville. A full-race '53 Cadillac engine is under the hood. Car holds drag-race records for its weight class, which is over two tons. George Cerny of Compton, Calif., filled in the hood to get cleaner lines and painted his car a coppery orange with a gold top. END

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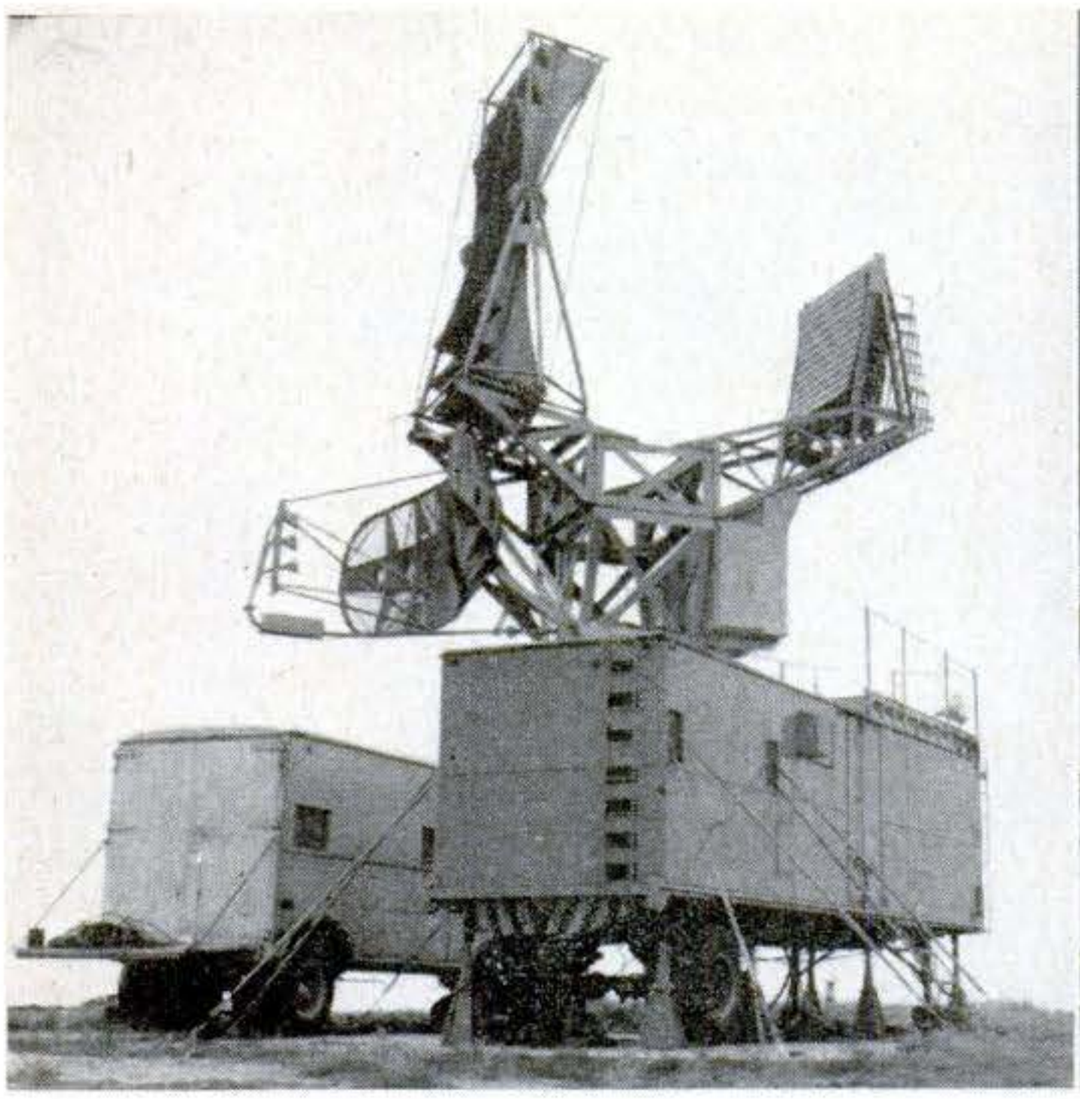

Electric-Eye Gun Helps Speed Military Planes to Landings

AN ELECTRIC-EYE gun is being used by the U. S. Air Force to help guide its jet airplanes to landings in thick weather. It's part of a brand-new system called Volscan. Old methods could line up planes with the runway for landings at the rate of only one each minute and a half. The new method will bring in and land a plane each half-minute.

Volscan has three parts—a conventional radar tracker to spot incoming planes (left above), a means of identifying each plane in which the "gun" (right above) is used, and an automatic computer which gives each plane a heading (direction to take) and figures out a safe rate of descent.

Here's how it works:

Radar produces blips, each representing a plane, on a screen in a landing-control office. When a blip appears, an operator "shoots" it with the gun. This throws a "gate" around the blip, isolating it from all the other blips. The heart of the system is the computer. It instantly digests information from the "gate" on the direction each plane is going, its altitude and speed. Then it spews out instructions on headings and rates of descent for each to follow to line up with the runway. This information is radioed to each pilot.

Rotating Wing Tips Give Plane Better Control at High Altitudes

A NEW idea for maintaining control of an airplane at high altitudes, where ailerons get less "grip" on the thin air, is under experiment in England. It's an oversize wing tip that rotates, providing more surface for the air to bathe. The experimental plane shown here is a jet. It was built by Short Bros. and Harland. Called the Sherpa, it has a wing span of 38 feet and a sweepback of 43 degrees.

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Jet-Propelled Weed Cutter Mows 20 Acres of Water a Day

PLANTS that choke fishing waters are cut down fast with this aquatic mower. A jet of water drives the steel hull at eight miles an hour, 1,150 gallons per minute being squirted to the rear by a centrifugal pump driven by a Jeep motor. Cutting is done by a sickle knife that reaches vegetation as deep as six feet below the surface. Ohio's Division of Wild Life says the mower can clear 20 acres of water in a day.

O-Man Can Twist Steel, Mix a Cake—or Fix an Atomic Engine

A MECHANICAL arm with enough muscle to lift 7,000 pounds will substitute for human brawn and skill in "hot" atomic areas. Its steel fingers, powerful enough to twist an iron bar into a knot (left above), are so sensitive that they can deftly break an egg and whip up a cake (right above). O-Man (for *o*verhead *man*ipulator) will work for GE on atomic engines, picking up, positioning and fastening heavy parts. It can saw, drill and tap holes, use power wrenches, hammers and riveters.

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Catching

It would cost hundreds of millions, but wouldn't it be nice to commute on a rubber-cushioned roadbed?

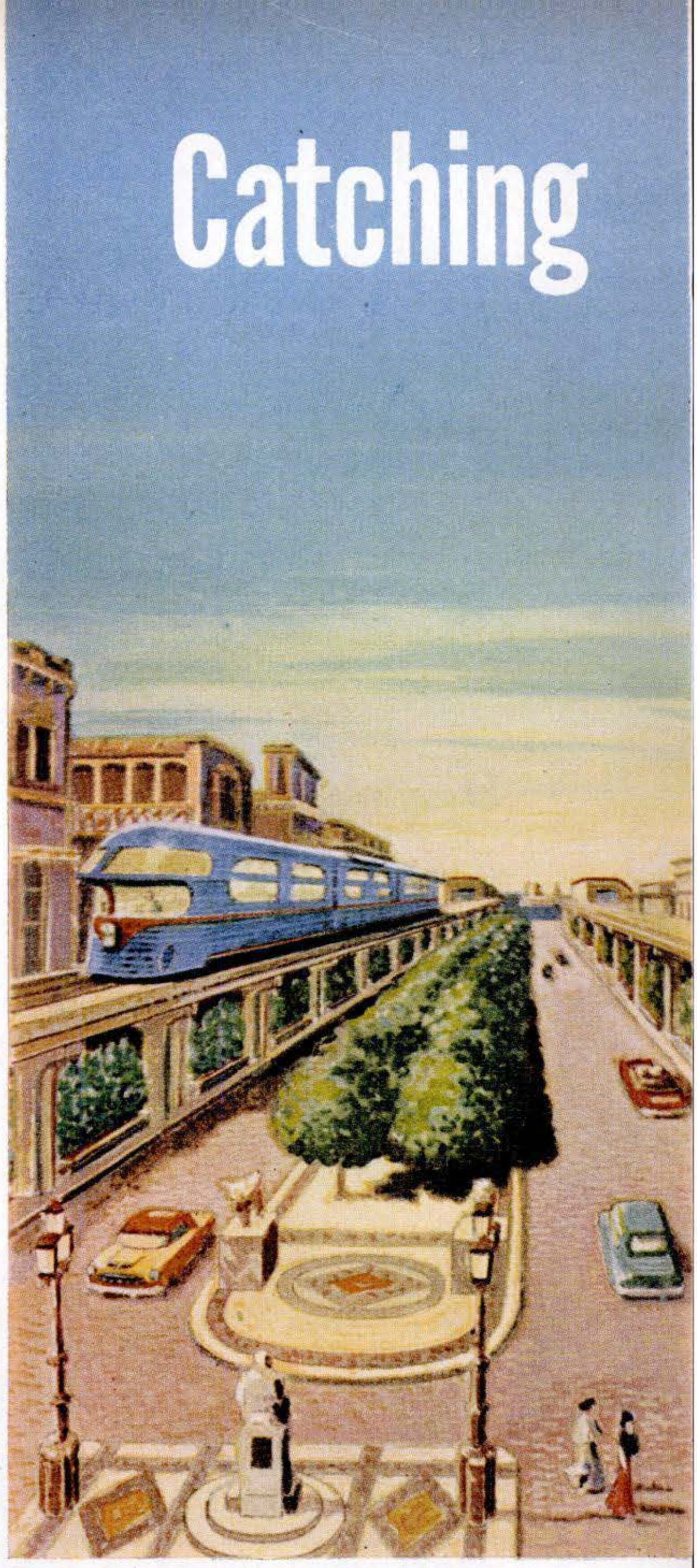
By Henry B. Comstock

EVERY commuter has a dream. In it, he enjoys a leisurely breakfast, strolls to the station, sinks into the padded seat of a streamliner and—*whoosh,* he's off on a 10-minute run to the city.

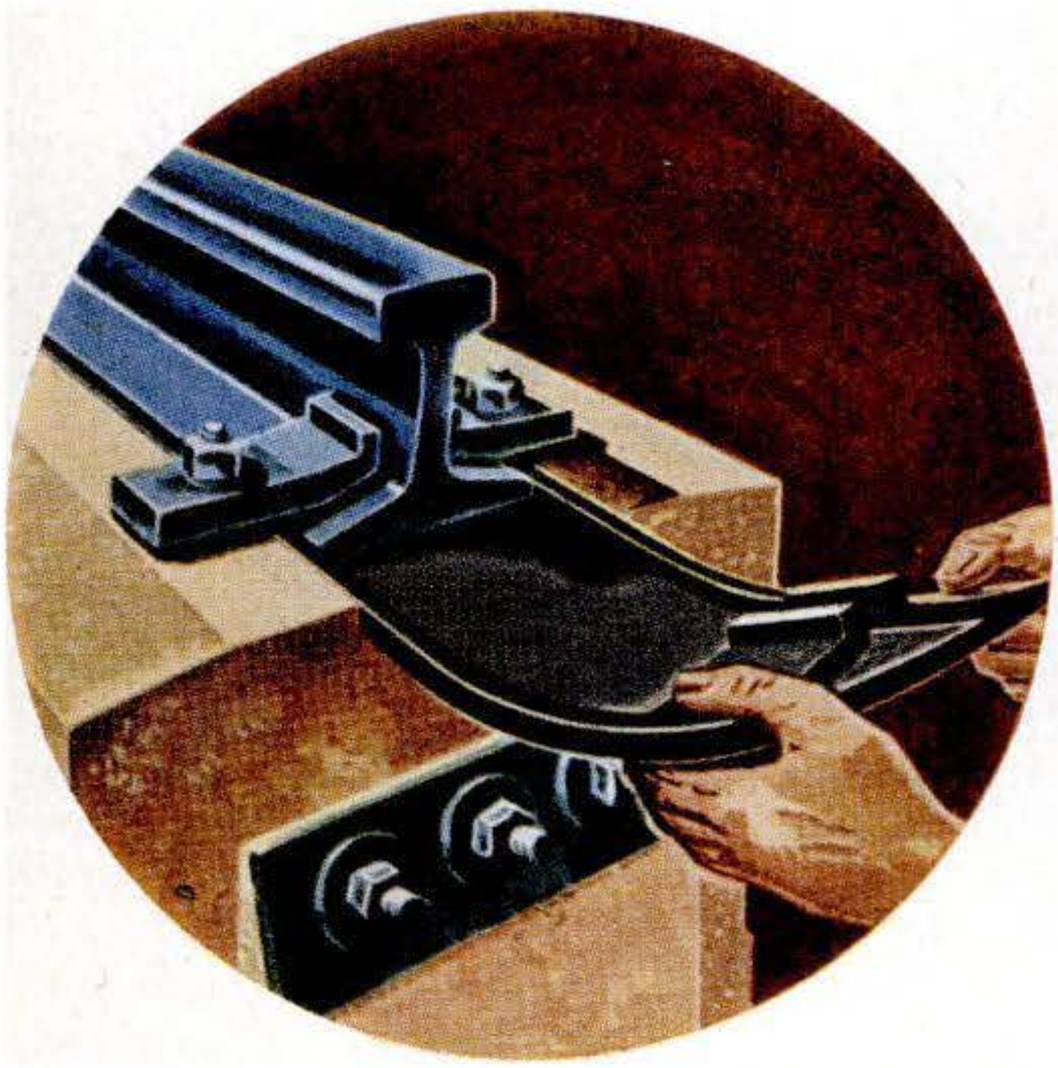
Now a rapid-transit expert claims that money, planning, new trains and new tracks could make the dream come true. The same techniques, he says, could give back to the railroads a lot of lost passenger traffic.

The man with the plan is John A. Hastings, a former New York state senator. He bases it on a new roadbed and an improved car truck. He holds patents on both.

The roadbed would be prestressed concrete—either prefabricated or cast at the site. In cities, this roadbed would be laid underground; in suburban areas the horizontal beams that hold the rails would be carried on vertical piers.



Havana is interested in John Hastings' new



KEY to 2½-mile-a-minute speeds and low maintenance costs, says Hastings, is a prefab, prestressed concrete roadway, with rails mounted on resilient rubber insets.

Hastings says his scheme would cost no more than building ordinary subways and railroads, and would result in:

- Cheaper maintenance, since there would be no ballast or tie replacement,

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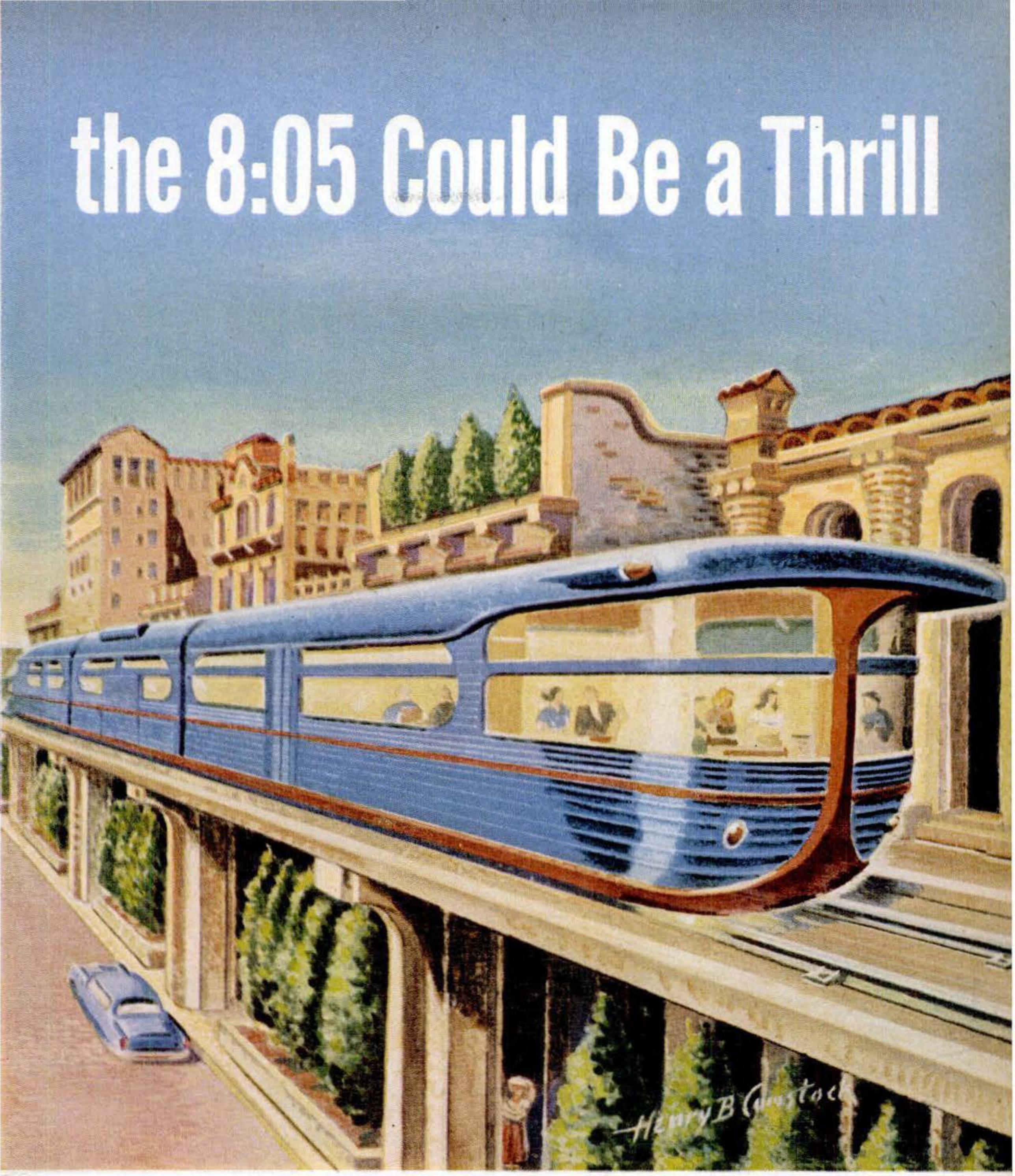
the 8:05 Could Be a Thrill



high-speed transit plan and its by-product: welcome shade for Cuban window-shoppers.

and regrading costs are eliminated. • Faster trains, since the stability of the fixed roadbed would minimize train sway and bumps.

Hastings' improved car truck is adapted from one developed to give street cars a smooth ride and quick acceleration. He has added rubber mountings to increase resistance to side sway and vibration. Each truck mounts an electric motor, to be powered either by a third-rail or a diesel-driven generator in the locomotive. Hastings plans to use the trucks on lightweight, low-hung trains,

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TOOLED OUT of bedrock 100 feet below mid-Manhattan, New Jersey and Long Island streets, eight subway stations would each be served by 28 high-speed passenger elevators—enough to whisk 20,000 commuters an hour to and from their coaches on the 8:05. Freight containers would descend on eight still-larger lifts from motor vans on street to flatcars below.

teamed with his precast roadbed. He predicts speeds of 100 to 150 m.p.h.

On a Hastings train you would pay your fare by the zone—like parcel post. He figures the cost at 15 cents for the first 15-mile zone, up to 50 cents for the 50-mile zone.

Cost: $900,000,000

Both train and track would be used in a Hastings plan to rush commuters into New York. Involving purchase of the Long Island Rail Road and new four-track tunnels from New Jersey to Long Island, this would cost $900,000,000.

Meanwhile, Hastings points out that any railroad could use his track and trains along with present equipment. So far, the railroads have done little but listen politely. They are skeptical of his system's technical features, and they are not eager to spend large amounts on declining passenger service.

As for our commuter, he can dream, can't he?

COMMUTER COACHES, each sharing a car truck with its neighbor, would be of two designs. For short runs Hastings proposes double-deckers; long-distance trains would have single decks. Trains shown here have articulated cars, but same truck could be used with conventional cars. Hastings claims his trains would cut equipment-to-load ratio from 26 to 1 to 5 to 1. Hastings' equipment could also be used with freights.

Copyrighted material

PASSENGER ELEVATORS

FREIGHT-INTERCHANGE CRANE

PASSENGER ELEVATORS

TWO-LEVEL STATION PROVIDES 6½-ACRE H-BOMB SHELTER

ESCALATORS

COMBINATION CABOOSE AND FREIGHT-CONTAINER CAR

FREIGHT-CONTAINER LIFTS

BEHIND their cabs, Hastings' locomotives would be flatcars on electric trucks. Diesel-generator "packages" would be added to tailor each engine to its load. Additional space could be used for freight containers, which could also be carried on vans, barges and planes.

TRAVELING CRANE

FREIGHT CONTAINER

DIESEL-GENERATOR PACKAGE (400 HP.)

800 LOCOMOTIVE HP.

Copyrighted material

There's Lots of Station Wagon in this 21-foot, 12-passenger job in which rear-seat occupants ride sitting backwards. Seats and walls are covered with two-tone leather. The carpeting is inch-thick, turquoise wool chenille. The car is air-conditioned, and recessed in one wall is a completely fitted beverage cabinet.

The chassis and 180-horsepower motor are by Packard. The super de luxe body and interior are by the Henney Motor Co., Freeport, Ill., custom-car builders and the biggest makers of hearses in the U.S.

The company's president, C. Russell Feldmann, had the king-size buggy built for his personal use and for advertising. Want one?

Ever Wanted to See what goes on inside a moving escalator? The management of Rich's Store for Men, Atlanta, Ga., thought their customers did—and here's the result. During a general alteration in the store, the moving and other parts of the Westinghouse electric stairway were painted different colors, and the opaque side walls replaced by several see-through glass panels.

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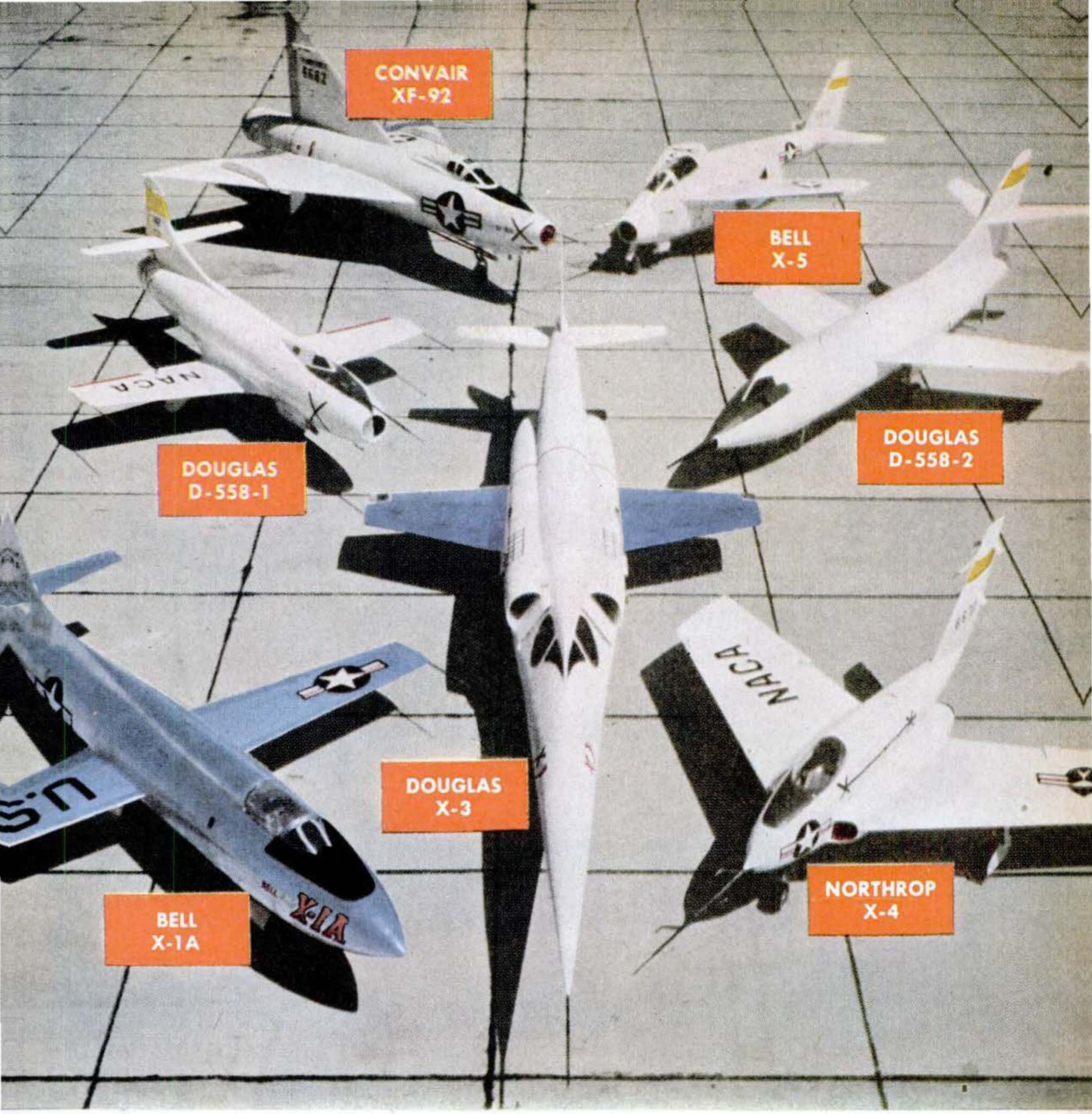

Fast Company: These odd-looking speed champions, each built for a specific research project, are lined up at California's Edwards Air Force Base. There recently the one at lower left, the Bell X-1A, set a new unofficial speed record of 1,650 miles an hour. During that spectacular flight the plane, piloted by Maj. Charles E. Yeager, tumbled nearly 10 miles before it was again brought under control.

As to the others: The Douglas D-558-1 Skystreak set a world record back in 1947, going more than 640 miles an hour. Six years later, its more powerful brother, the D-558-2 Skyrocket, was the first plane to fly at twice the speed of sound—1,327 miles an hour. It can fly higher than 80,000 feet.

The XF-92 was built to test delta-wing configuration and the X-5 to study the effects of changing the degree of wing sweep in flight. The latter was recently destroyed in a crash. The X-4, a relative slowpoke in the field, was designed for swept-wing research at subsonic speeds.

In the center is the "flying stiletto," probably the speed champion of them all, although its supersonic performance has not been announced.

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Patients Enjoy This Hospital

Push-button comforts, traffic control and resort spirit help banish blues at Los Angeles' Kaiser Foundation.

By Ronald M. Deutsch

WHEN the last happy tears were shed and the last flowers given, one of the visitors in Rita Schlanger's maternity-ward room asked the inevitable question: "Can we see the baby?"

Smiling shyly, Rita reached to the head of her bed and drew out a white steel drawer. There, in a clear plastic bassinet, lay her two-day-old son, Jay.

"Isn't it wonderful?" she said. "I can have him with me all the time."

The traditional sighs and cooings over, Rita simply closed the drawer. Young Jay slid back into his private, soundproof nursery and a light flashed in the corridor to warn the nurse that Baby was back in her charge.

Rita touched a button and her bed slowly lifted her into a comfortable sitting position. "Honestly," she said, "it's just like living in a hotel."

To prove her point, she leaned back and began to demonstrate enough gadgets to fill the cockpit of a Sabrejet.

Life Is Easier for Patients and Staff

The new, supermodern Kaiser Foundation Hospital in Los Angeles, in which Rita Schlanger lounged in maternal ease, is a model of every comfort and convenience that its designer, Dr. Sidney Garfield, could dream onto the planning boards.

"We're not trying to spoil our patients," said Maternity Floor Supervisor Zoe Barbara Brown. "Actually all these gadgets

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Special bed tray serves also as vanity table, dinner table, writing desk or phone stand.

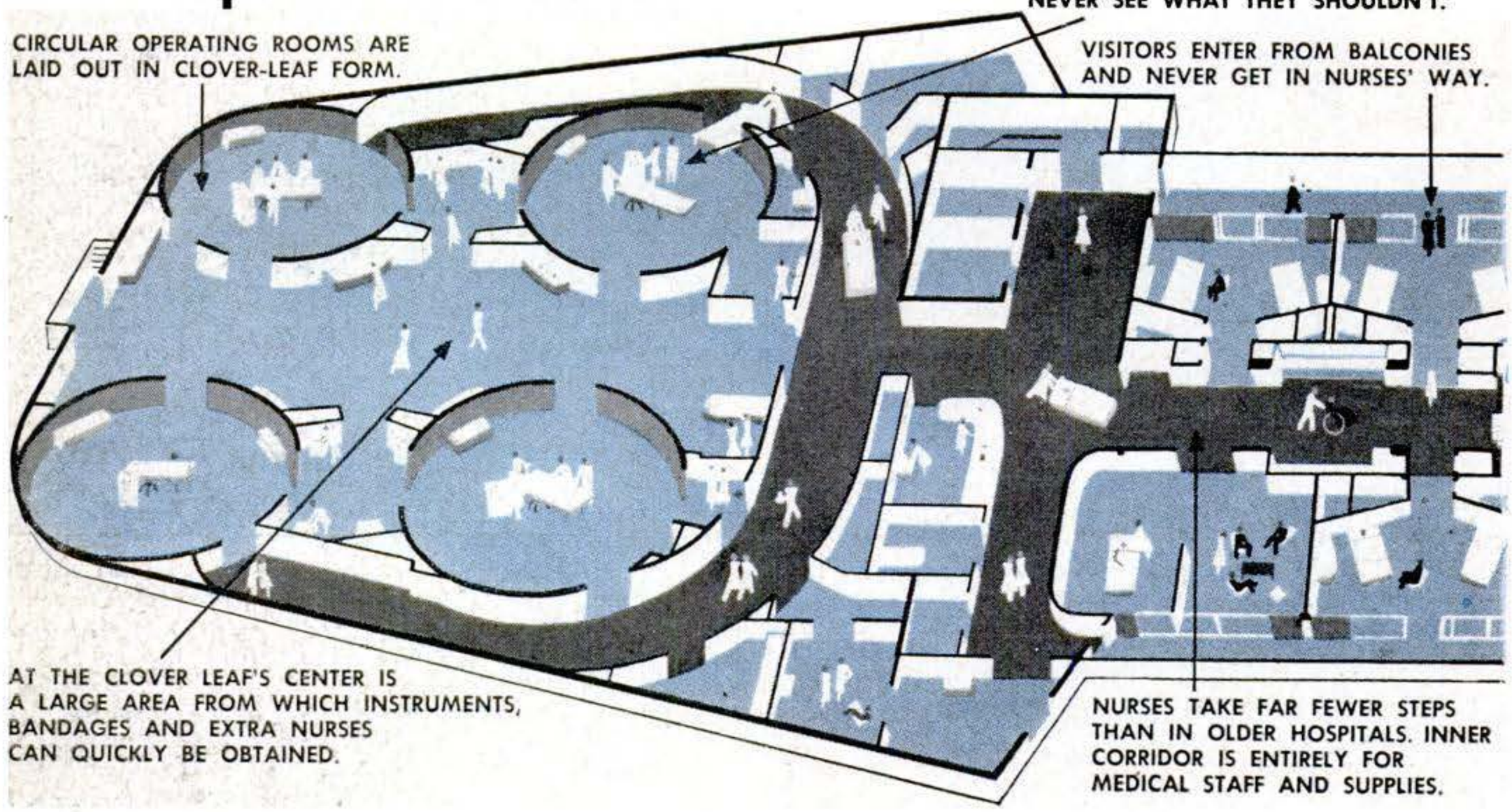
Fun and games for the convalescents make the hospital's "hotel floors" especially cheery.

NERVE CENTER of each floor is the supervisor's desk, linked by intercom to individual nurses' stations. Dumbwaiters at the rear speed deliveries to and from supply room and lab.

help them take care of themselves. It's a funny thing, but the more we do to make life easy for the patients, the less work there is for the staff."

Each of the hospital's five lower floors has three corridors: a central working corridor reserved to the staff, and two balcony-like outside corridors used by visitors. Patients' rooms are entered by all but hospital personnel through plate-glass doors that open onto the balcony.

How Hospital Traffic Moves



TUNING IN A PROGRAM on the communal radio, a bed patient simply yanks a chain pull. She has a choice of three stations. Her earphone is the flat disk lying by her head.

"This is a real boon," said Nurse Brown. "There's hardly any traffic at all in the working area. Visitors never interfere with hospital work, never see anything they shouldn't see. Patients are protected from noises, sights and odors that might be unpleasant."

Each nurse's station is a model of compact efficiency. She has her own intercom system, which connects her to the floor supervisor's desk and to all points in the hospital. By her desk are individual medicine cabinets for each patient, and the patients' charts are posted outside their rooms. She has a charge-a-plate system, like the ones used in department stores, to save her time in filling out forms.

At each station are central storage points for linens, bandages and drugs,

[Continued on page 260]

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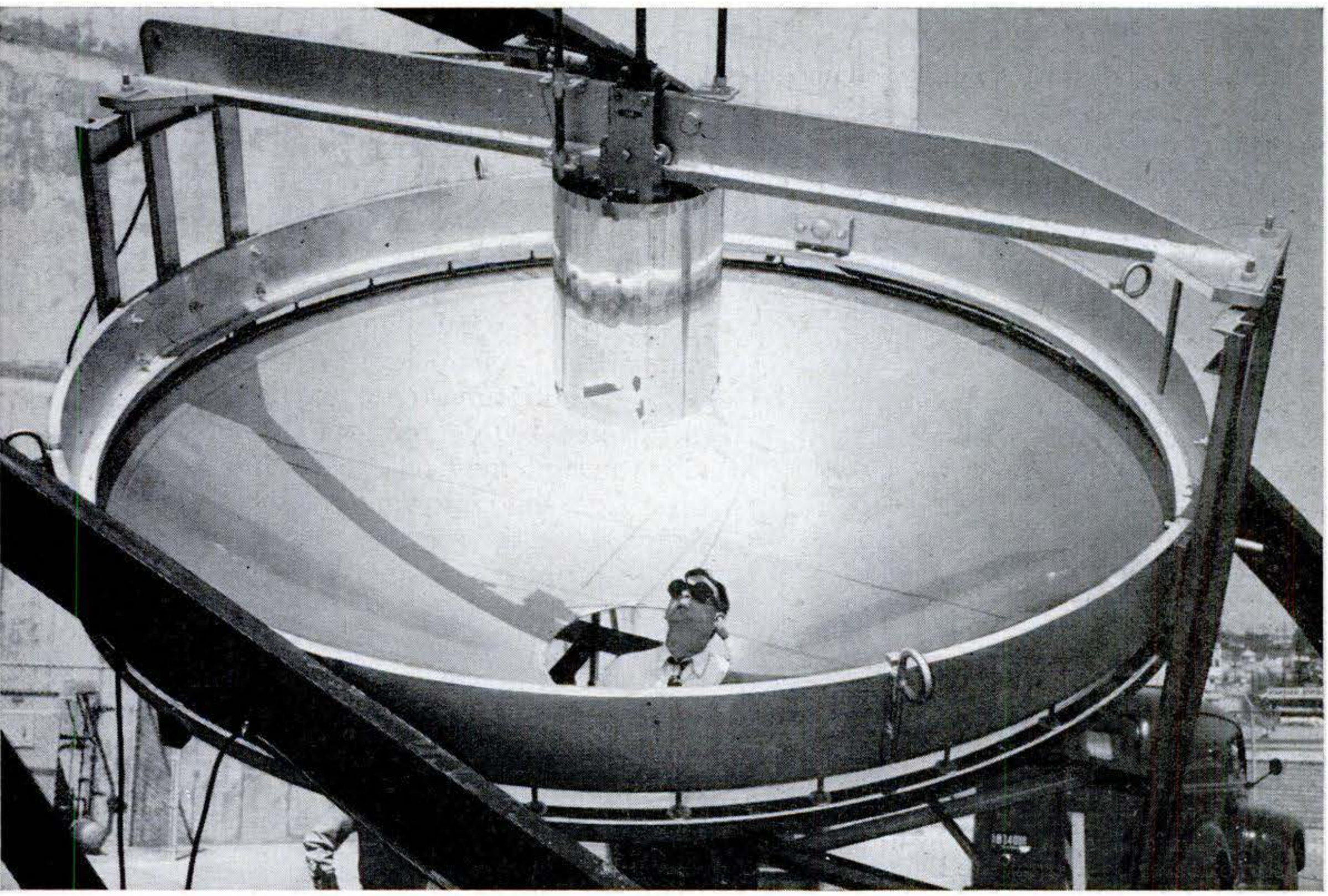
Sun Furnace Goes to Work

A man-made inferno tries out materials for jet and rocket engines—and shows one way to capture free solar power.



Ten-foot mirror of solar furnace concentrates sun's rays to yield heat of 8,500 degrees.

By Alden P. Armagnac

ATOP a 6,000-foot mountain near San Diego, Calif., they're harnessing the sun to help build airplanes.

A solar furnace newly installed there focuses the sun's rays, with a 10-foot-diameter mirror of polished aluminum, upon a spot smaller than a dime. It surpasses by far the temperature of the hottest blowtorch or electric furnace.

Researchers of the Consolidated Vultee Aircraft Corporation apply the sun furnace's terrific heat to materials under trial for jet and rocket engines and for guided missiles. Aim of their experiments is to develop substances more resistant to heat and thermal shock than any yet known—stuff that won't soften and flow, say, when a long-range missile screams back to the earth from dizzy altitudes.

That the possibilities are promising is

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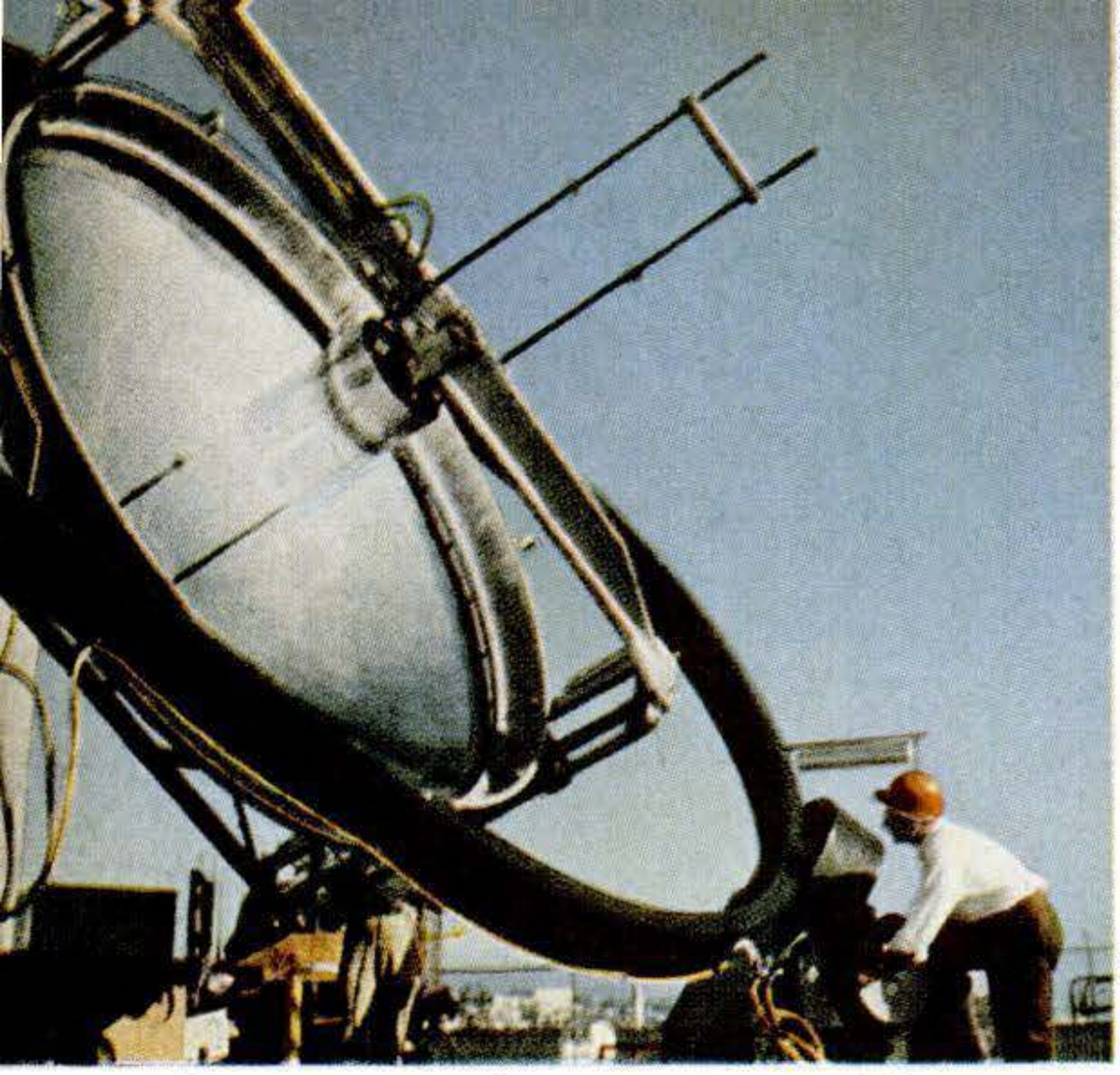
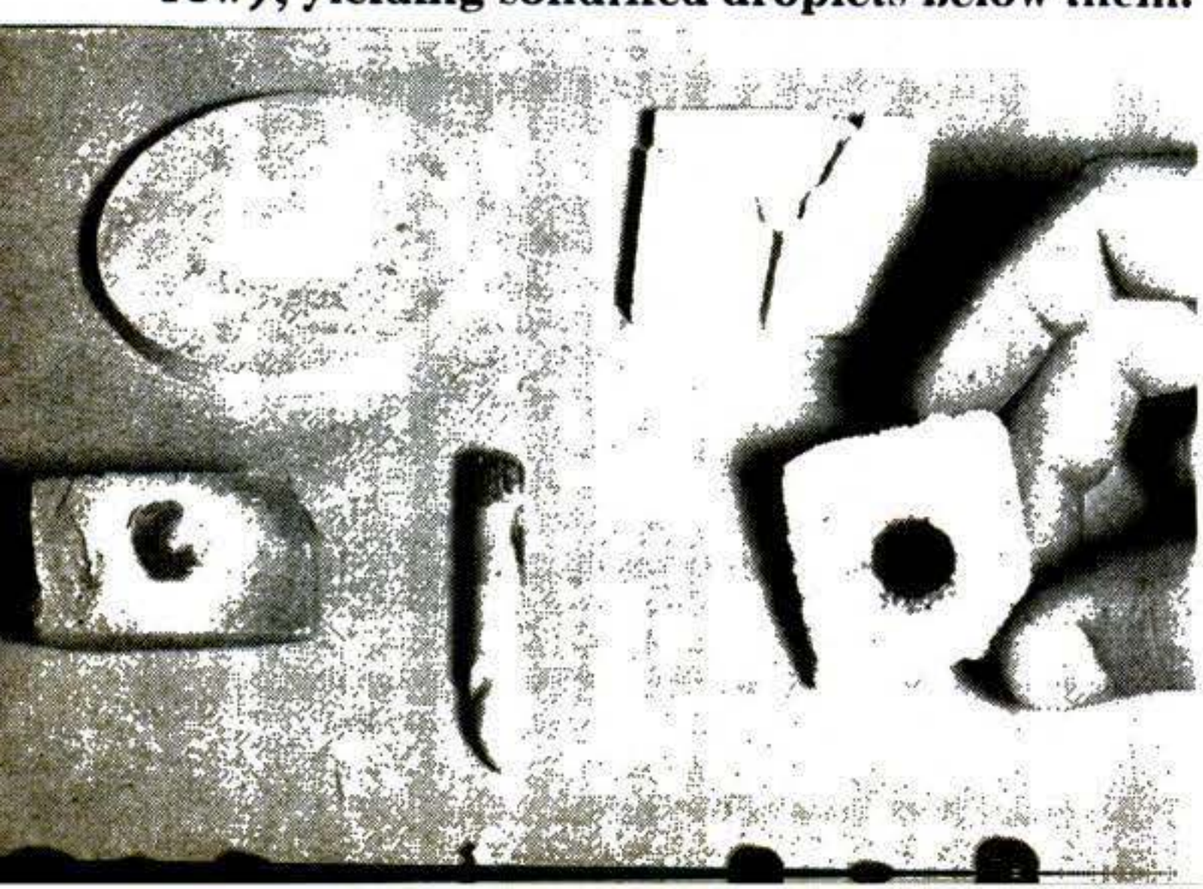


Turning in gimbals ring, mirror follows sun. Observer takes temperature with a pyrometer.

BURNING-GLASS PRINCIPLE is applied by solar furnace. Its concave mirror acts like a lens to focus sun's rays, as shown by using photoflash reflector as a cigarette lighter.

SOME TEST SAMPLES of high-temperature materials are flaked or cracked (top row) by sun furnace's heat. Others melt (center row), yielding solidified droplets below them.



shown by recent discovery of two super-refractories, hafnium carbide and tantalum carbide, with fantastically high melting points—7,530 and 7,020 degrees F., respectively. The first looks like the record for any substance known. For comparison, iron melts at a mere 2,800 degrees, and tungsten tops the list of metals at 6,100 degrees; while graphite, long the supreme heat-resisting material, turns from solid into vapor at about 6,600 degrees.

The California experimenters' solar furnace, essentially an enormous burning glass, provides the most practicable way to explore this newly opening extreme-high-temperature realm. When sky conditions are ideal, it yields an estimated maximum of 8,500 degrees F. At the focus of the great mirror, this heat is concentrated in a spot 5/16 of an inch in diameter.

Metal Melts Like Butter on a Stove

Its intensity burns a hole in firebrick with ease. Steel melts and drips like sealing wax over a flame, when a rod is held with its tip at the focal point. A movable cylindrical sunshade controls the temperature of thousands of degrees to within a degree or two, a triumph of precision. Equipped with an astronomical drive, the big mirror turns automatically to follow the sun, permitting experiments of hours' duration.

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Metal jaws hold specimen—here, firebrick—at focus of mirror. The result is shown below.

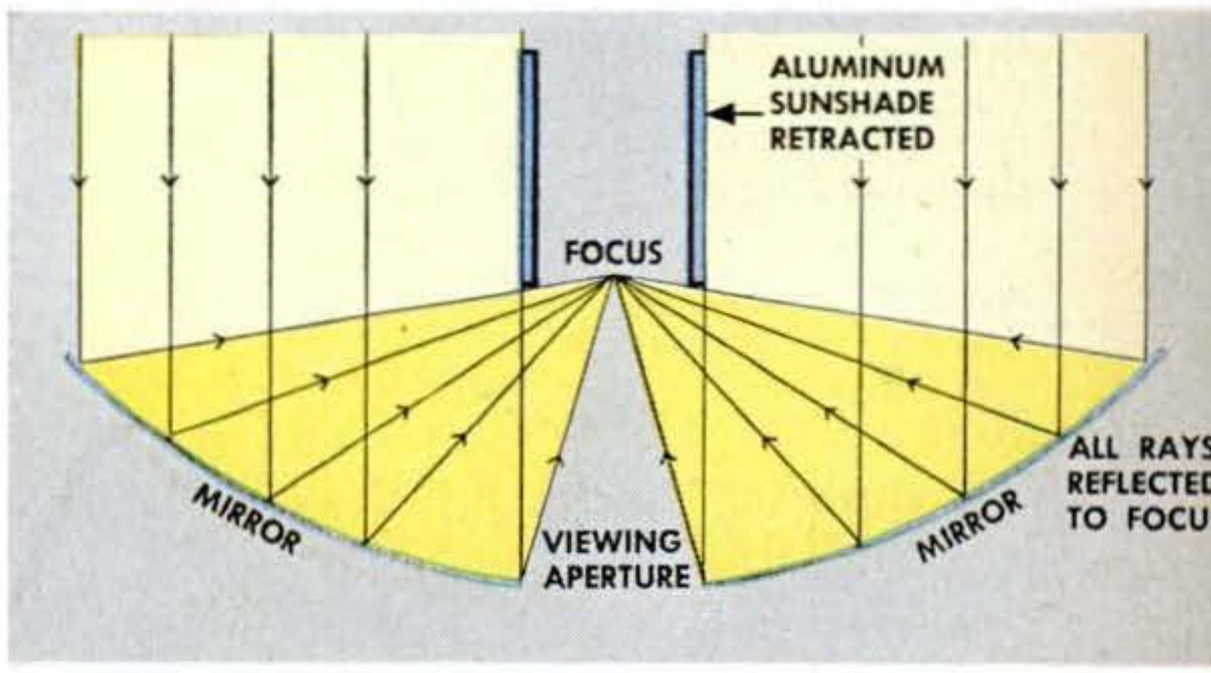
Best of all, pure samples of materials can be subjected to the searing heat without contamination by foreign substances, like carbon in electric furnaces. And there are no electric and magnetic fields, nor fumes, to disturb reactions or hinder spectroscopic observation.

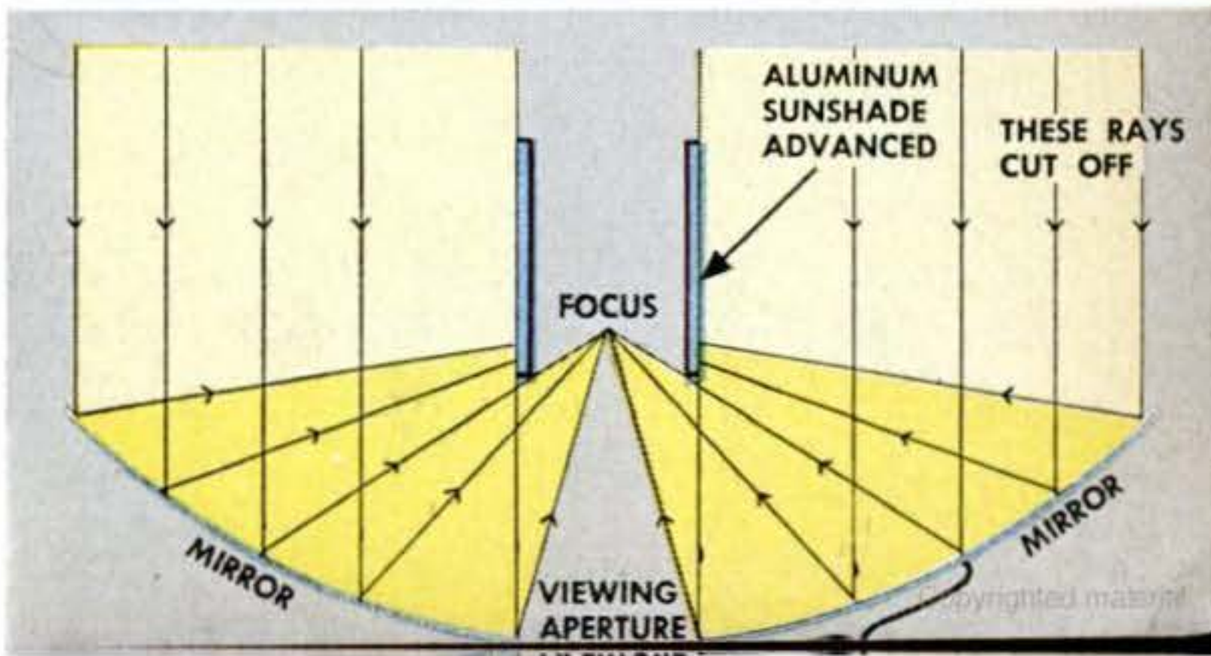
Science's Pioneers Led Way

In going to work for industry, the solar furnace has exchanged academic robes for overalls. For its advantages long were appreciated only by savants of pure science. Lavoisier and other great chemists of the past melted metals with solar furnaces, which made up in size whatever their lenses or mirrors lacked in optical perfection. Then the idea seems to have been forgotten, until recent years.

Abroad, French experiments that began a few years ago with a 78-inch searchlight mirror (PSM, Aug. '50, p. 122) have now led to what is probably the world's largest solar furnace. Using a 40-foot-diameter composite mirror, a mosaic of small panes of window glass, this semi-industrial installation in the Pyrenees went into operation in 1952.

In this country, first practical use of a

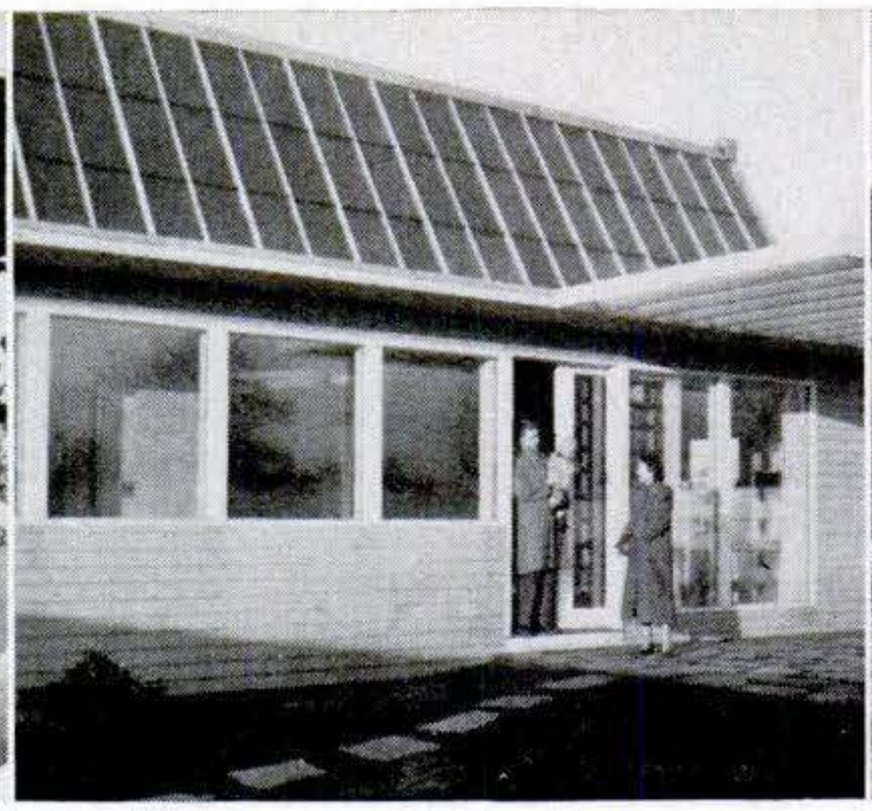




HOW IT WORKS: Cylindrical sunshade controls heat on specimen at focus, as shown in sketches at right. Aperture in mirror enables observer to take temperature with optical pyrometer and watch test through telescope.

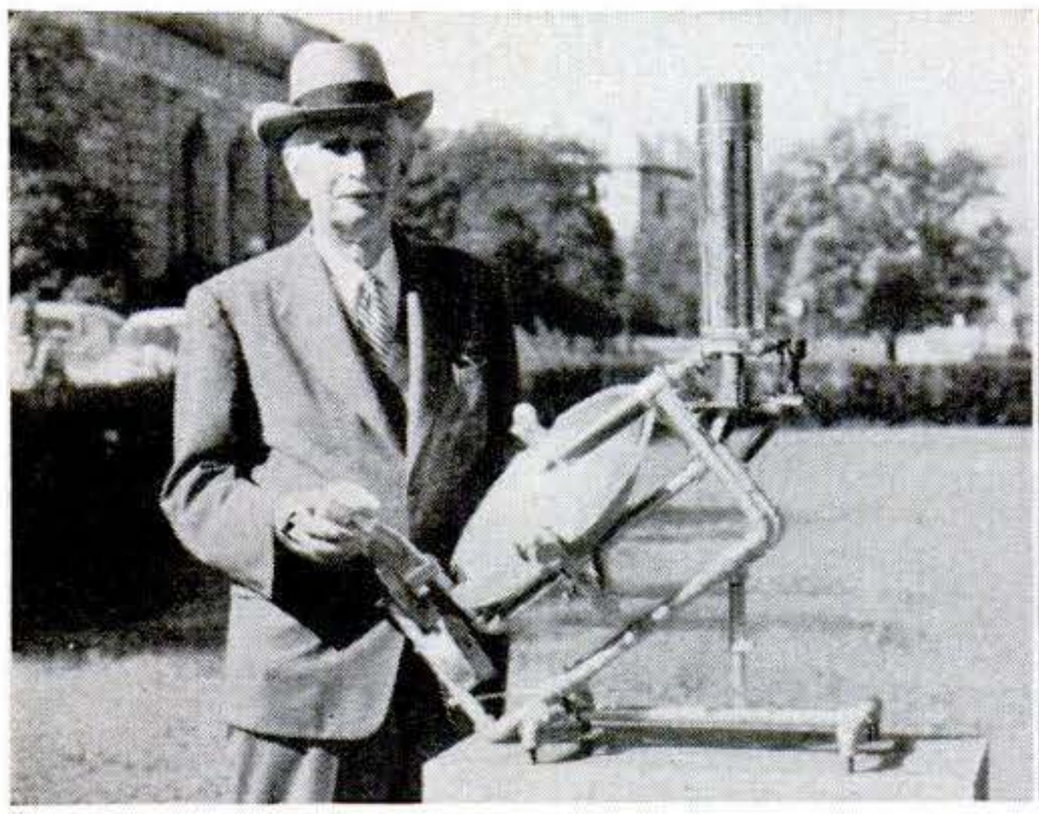
FOUR WAYS THE

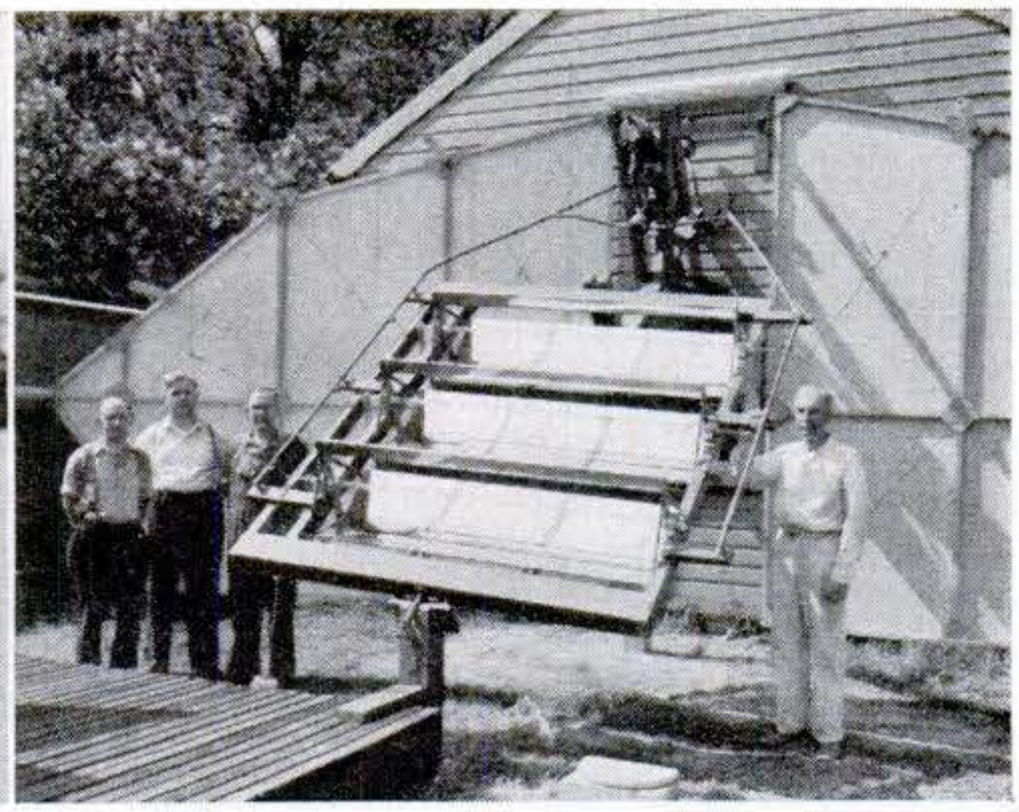
HEAT ENERGY FROM SUNSHINE



SUN COOKS MEAL (left above) in reflector-type solar heater developed in India, where fuel is scarce. Solar house (center) developed by MIT scientists is heated with water warmed by sunlight, which falls on black-painted metal in glass-covered boxes along roof. Solar still at right distills drinking water from the sea.

MECHANICAL ENERGY FROM SUNSHINE





RUNNING STEAM ENGINES by solar power is feat of Dr. Charles G. Abbot of Smithsonian Institution, who has worked on problem for 20 years. At left above he exhibits model of his latest solar boiler. One of his earlier models (right) is shown driving a half-horsepower steam engine, mounted on a frame above three mirrors.

solar furnace appears to date back only a little earlier, to a little-known project of World War II. A 120-inch sun furnace was built for the AC Spark Plug Division of General Motors at Flint, Mich., with the cooperation of the Aluminum Company of America. Originally 16 reflecting sectors of quarter-inch sheet aluminum gave it a saucer-sized hot spot, of up to 2,000-degree temperature and five-inch diameter. After the war, when it became surplus, it was moved to Rockhurst College in Kansas City, Mo., and used in scientific studies by its designer, Dr. Willi Conn. Having reshaped the mirror to obtain a smaller hot spot and much higher temperatures, he perfected the technique of controlling and measuring the extreme heat accurately.

New Owner, Final Version

This is the sun furnace that Consolidated Vultee has now purchased, modified further to suit its new tasks, and put to work. Incidentally, moving the furnace southward in latitude from Kansas City

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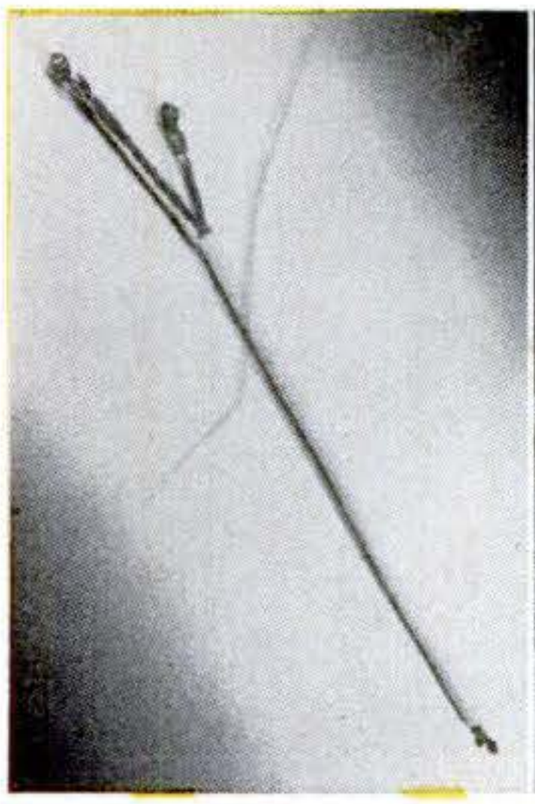
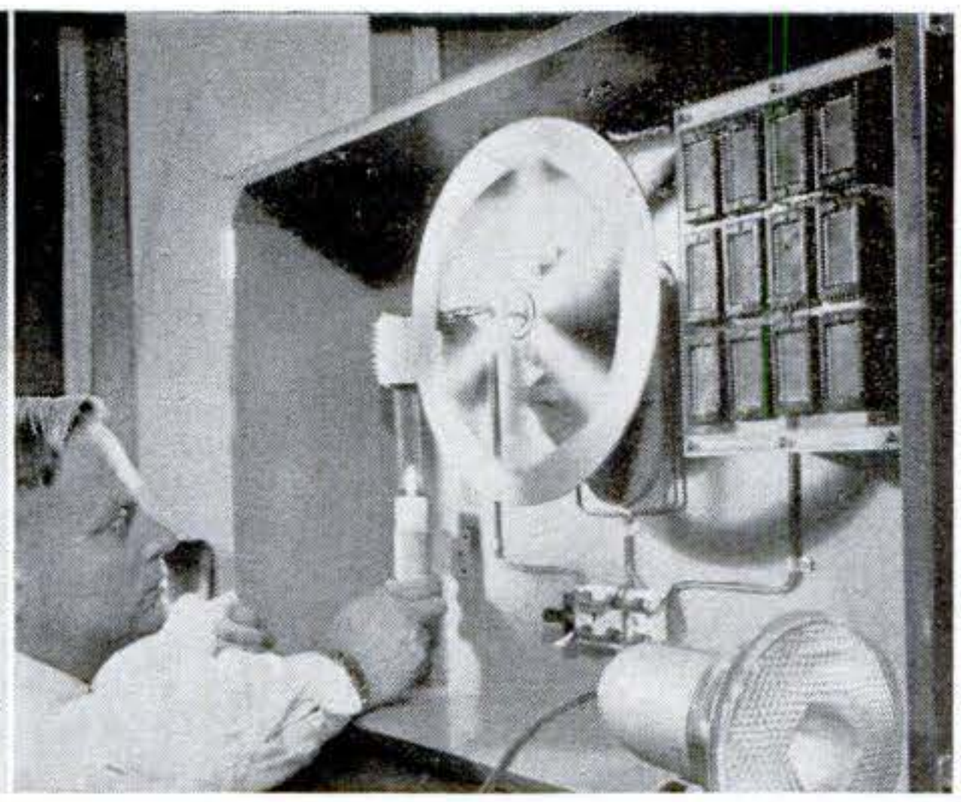
TO HARNESS SUN

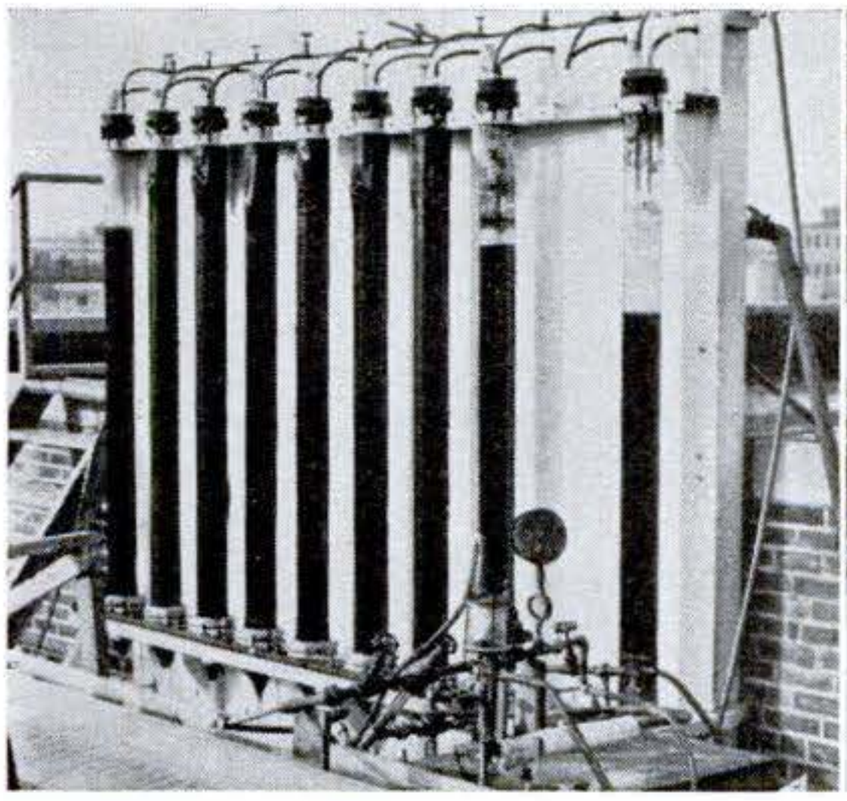
ELECTRICAL ENERGY FROM SUNSHINE

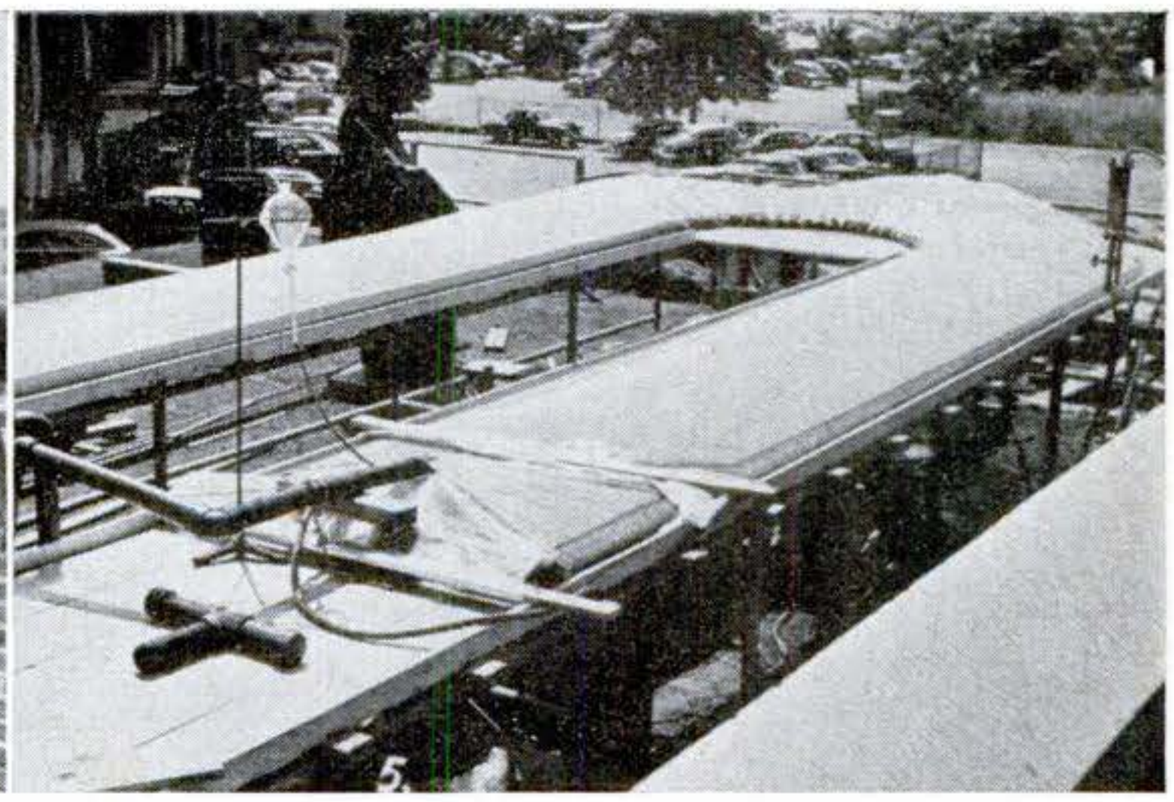




SUN MOTOR (center above) shows sunshine could be converted into electricity by thermocouple (left) or photovoltaic cell (right). Motor runs on current generated when sun, or a candle, heats thermocouples as in above illustration; or when a lamp, representing sunlight, is turned on photovoltaic cells.

CHEMICAL ENERGY FROM SUNSHINE





CHLORELLA ALGAE, thriving in water and salts under carbon dioxide, harness sunlight for food more effectively than farm crops. Yield could feed livestock. In rooftop trial for Carnegie Institution, Arthur D. Little, Inc., of Cambridge, Mass., raised algae in six-foot columns (left above), then in a plastic tube (right).

to San Diego required a new mounting for the big mirror—it turns in its gimbals ring, like an astronomical telescope, on a "polar axis" parallel to that on which the earth turns.

To scientists looking into the future, solar furnaces illustrate just one of many ways to harness the sun. The tantalizing fact is that a full horsepower of solar energy, free for the taking, falls at midday on each square yard of the earth. What progress experimenters are making toward capturing it was recently reviewed by Dr. George R. Harrison, dean of the MIT School of Science.

India Has Solar Cooker

Devices using the sun's heat directly, as the solar furnace does, represent the simplest approach and the most successful to date. India has perfected a solar cooker, which a government agency now sells for $14, using a circular mirror of yard-square area. Solar stills on life rafts make drinking water from sea water.

[Continued on page 266]

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GRASSHOPPER

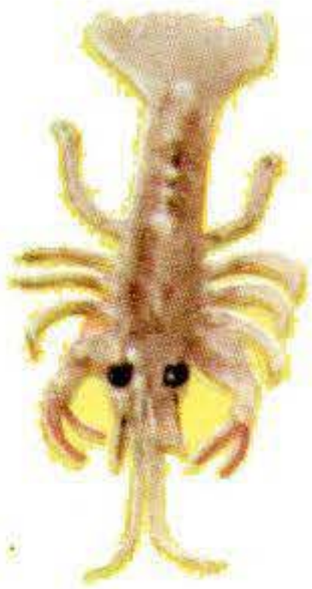
DRAGONFLY NYMPH

SPIDER

HELLGRAMMITE

MAY-FLY NYMPH

CRAYFISH



ANTS

SPIDER

Charlie Burke of Michigan has molded a million lures of plastic, and the silly fish still think they are real.

By Wesley S. Griswold

I KNOW a man who *has* to go fishing every few days in order to stay in business.

His name is Charles I. Burke, and he lives in Traverse City, Mich. He makes plastic nymphs, grubs, insects and tiny crustaceans that fish lose their heads over. In fact, he's made a million of them. But he keeps trying out new ideas on the fish.

His artificial lures even fool people. The other day, one of the town's practical jokers, chatting on a street corner with a friend, stealthily reached into a pocket for one of Burke's grasshoppers and unobtrusively flipped it onto the sidewalk. His friend saw the bright-green plastic insect apparently hop into view, and instinctively stamped solidly on it.

"Hey!" yelled the jokester, in mock indignation. "What's the idea of bending my hook?"

"Hook?" said the victim, lifting a heavy foot off the grasshopper and staring down in disbelief. "Well, I'll be—"

Many trout and bass have made a similar mistake.

He Wasn't Enjoying Life

Burke, who has been a devoted fisherman ever since he was old enough to wet a line, started making plastic lures in the basement of his Detroit home in the fall of 1949. He was then 36 and a research chemist for a large firm that makes plastic products for automobiles. He was being paid an adequate salary but he wasn't enjoying life. He was suffering

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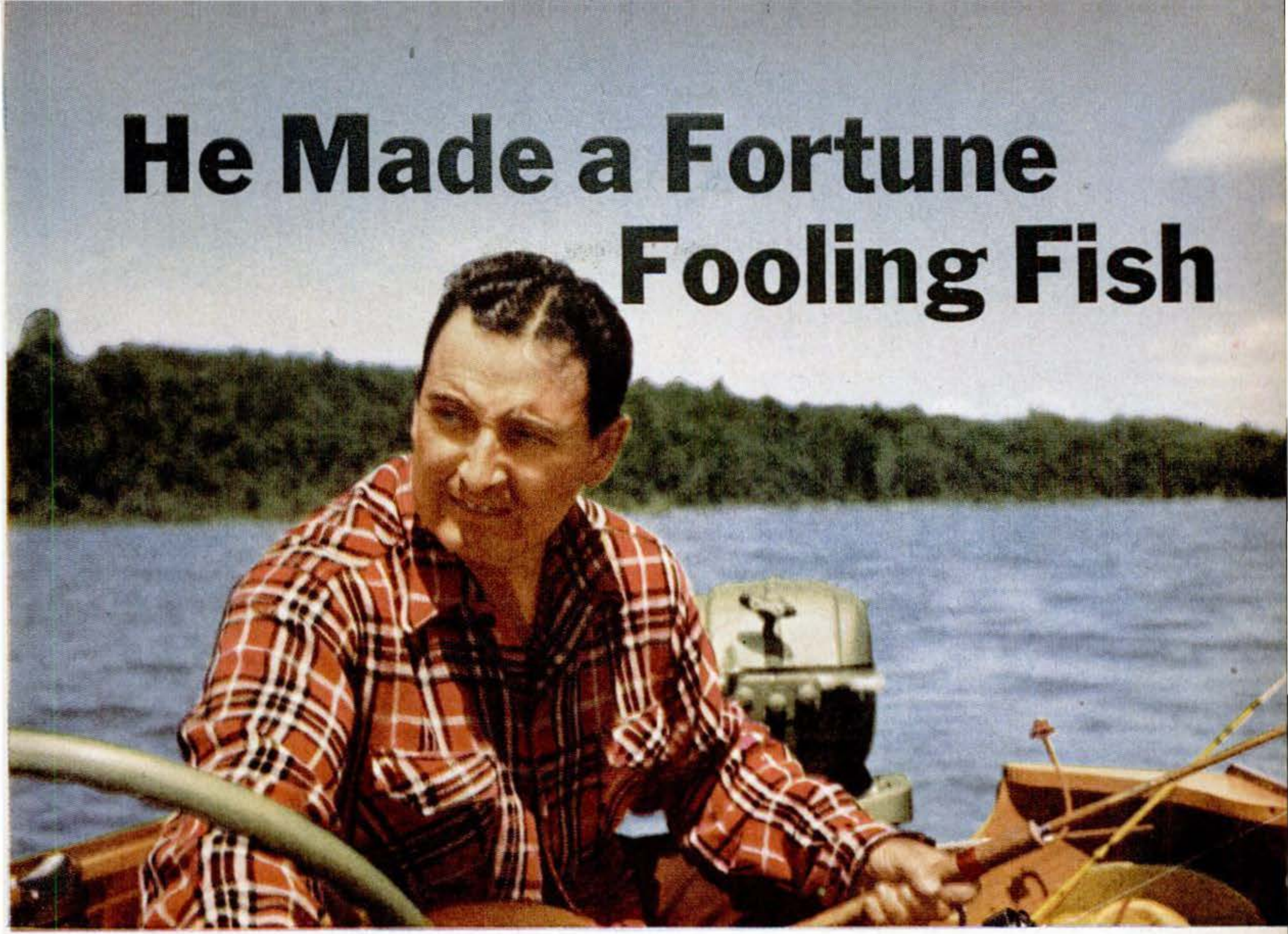
He Made a Fortune Fooling Fish



from nervous tension, a few persistent respiratory ailments and an inability ever to find time to go fishing.

A few days earlier, in the midst of tackling an assignment to produce soft, waterproof plastic work gloves, one of his helpers, who was also an enthusiastic angler, had made a casual remark that changed the course of Burke's life.

"You know," the man had said, "I'll bet somebody could make artificial lures out of this stuff."

A Pickled May Fly for a Model

The idea appealed to Burke at once, and the longer he considered it, the more excited he grew. Finally, one evening on the way home, he bought an inexpensive metal-engraving set, a small plate of scrap aluminum and a modest amount of powdered polyvinyl chloride and went to work.

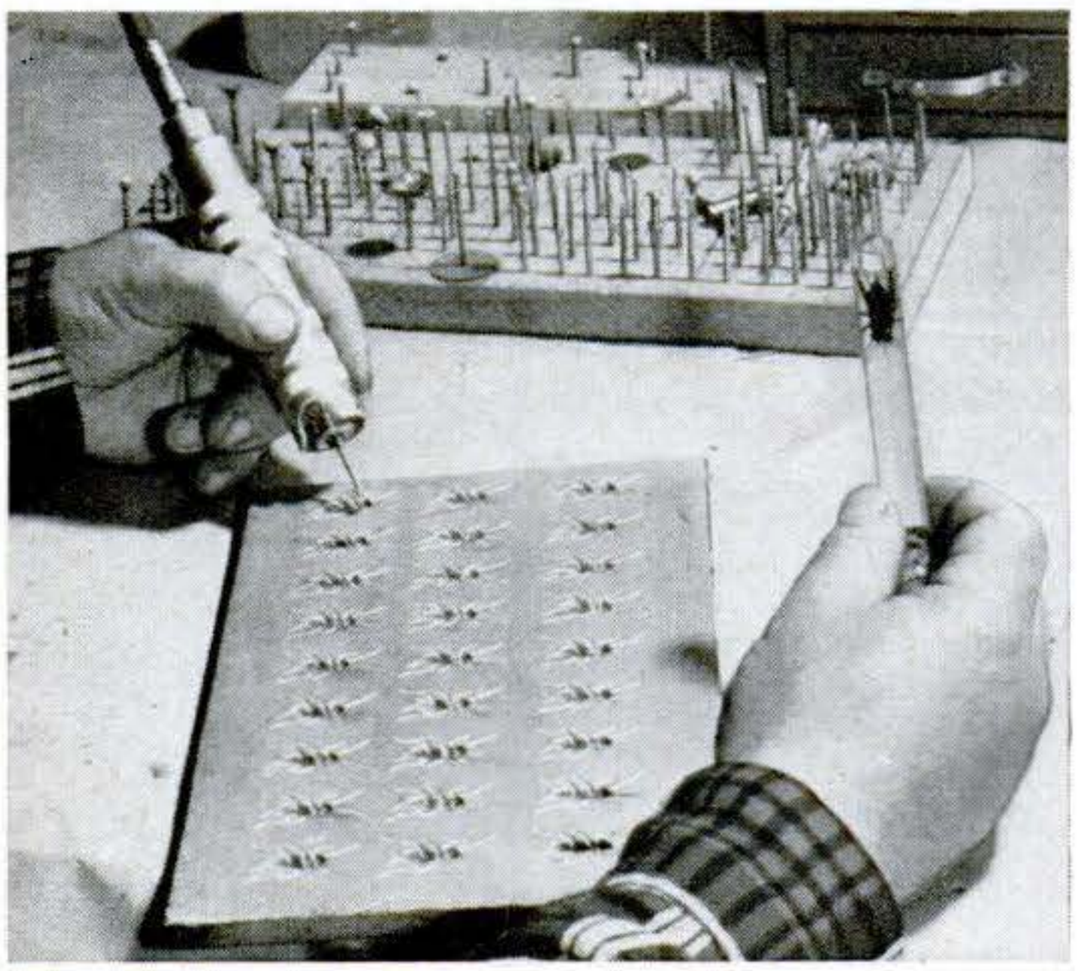
Using a pickled May-fly nymph for a model, Burke etched 10 reverse copies of it in the aluminum plate. He had never had a day's training in art, but the copies looked fine.

He then mixed a plastic brew and poured it into the half-molds. For heating the first trial batches, he used an infrared lamp and guessed at the proper length of time for curing.

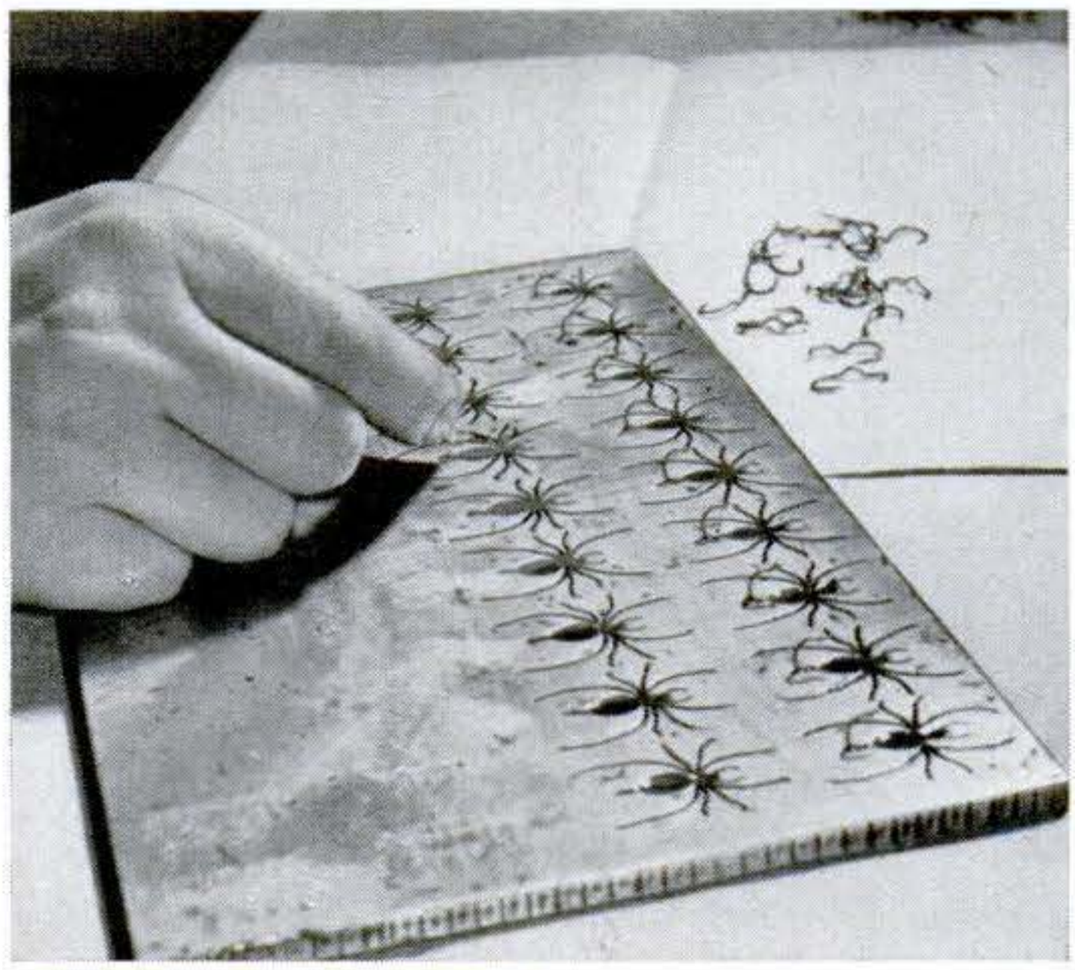
When at last he had hit upon the

BURKE'S LURES arrayed on a dainty hand look so real that you can almost see them crawl.

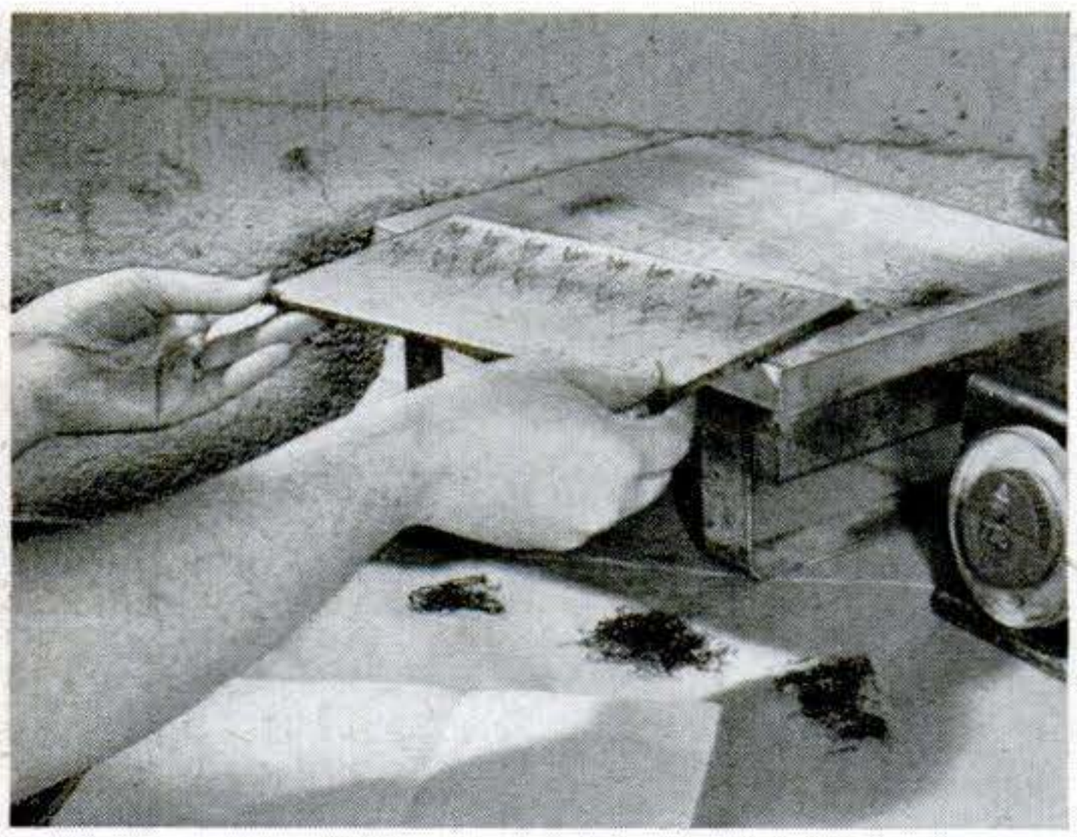
How Burke's Fish Lures Are Made



SOUTHPAW ETCHER copies a cricket, preserved in alcohol. Burke here demonstrates his method for making half-molds in aluminum plates of items that fish consider delectable.



INSERTING THE HOOKS in a plate of spider molds, already filled with liquid plastic. The hooks are laid on their backs in the tail and body cavities of the molds.



APPLYING THE HEAT to a batch of plastic insects. They cook on an electric plate at 350 degrees for from five to 15 minutes, depending on what's cooking. Photo timer is at right.

A BATCH OF SPIDERS comes off the hot plate, where their foam-plastic bodies rise like biscuits. The non-foam legs are made to dangle while the lighter bodies float realistically.

right curing time, he used a photographic timer to measure it exactly, and bought a waffle iron to replace the infrared lamp. The waffle iron was equipped with plates for toasting sandwiches. On these plates Burke set his aluminum molds for curing.

That first winter, selling mostly to fishermen friends, Burke marketed $1,440 worth of lures. He had already copied several other members of the insect kingdom to keep his May-fly nymph company, and had even etched a rather remarkable crayfish.

In 1950, two events occurred that converted Burke's lucrative hobby into what rapidly became a highly profitable business. The first was a visit to his doctor.

"Charlie," said the medico, "you've just got to get out of Detroit. This climate will kill you."

"Where'll I go?" Burke asked.

"Well," the doctor replied, "why not Traverse City? That's one of the healthiest places in Michigan."

Traverse City had other charms for

[Continued on page 256]

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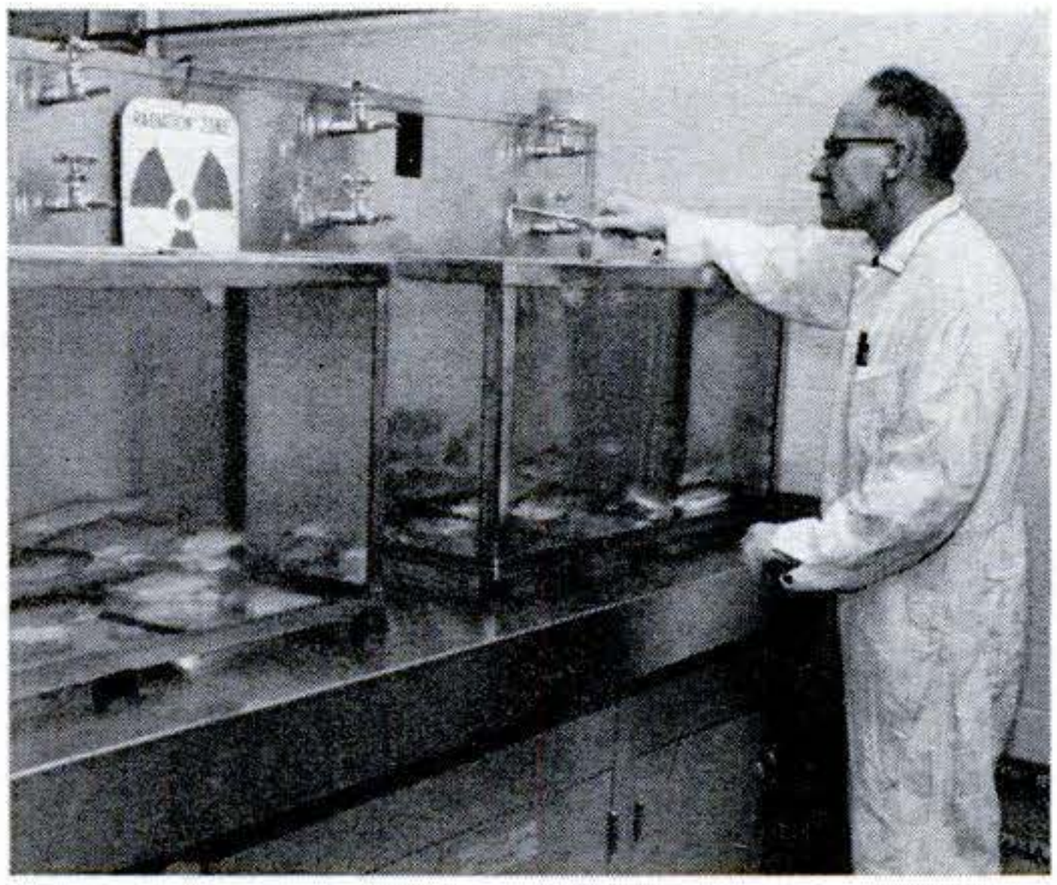
Hardtop Offers Sky View

A WHOLE roof of clear plastic has been built into "La Comtesse," a styling experiment by the Chrysler Corp. The car is a New Yorker model hardtop with a 235-hp. engine. It has a continental rear tire mount, special chrome moldings along the bottoms of the fenders and doors, and an interior trim of dove-gray leather.

▶▶▶A new insect repellent called M-1960 is applied to cottons or woolens during laundering or dry cleaning. It contains benzyl benzoate and is said to keep away mites, fleas, ticks, leeches and mosquitoes. But all present production goes to the government.



Trout Swim in "Hot" Water

WHAT happens to the fish when river water is used to cool giant reactors that turn out nuclear fuel? To find out, scientists keep an aquarium at the plutonium plant on the Columbia River at Hanford, Wash. In tanks beneath a radiation warning, the fish swim in the radioactive river water and feed on hot isotopes mixed with liver. Continuous studies in the plant's aquatic biology laboratory have shown that the radioactivity levels are so low that they are not harmful to fish or man.

Wanna Buy a Bag of Goldfish?

THESE fish are swimming in an airtight plastic bag, sealed in with an oxygen-releasing capsule. Goldfish farmer Roy Prewitt of Lonoke, Ark., says that one of his chemical capsules can keep half a dozen fish alive for about 17 hours.

▶▶▶To add income, Clemson College is curing blue cheese in an old railroad tunnel. The South Carolina school, owner of a 650-head dairy herd, says the cheese is as good as the Roquefort cured in French caves.

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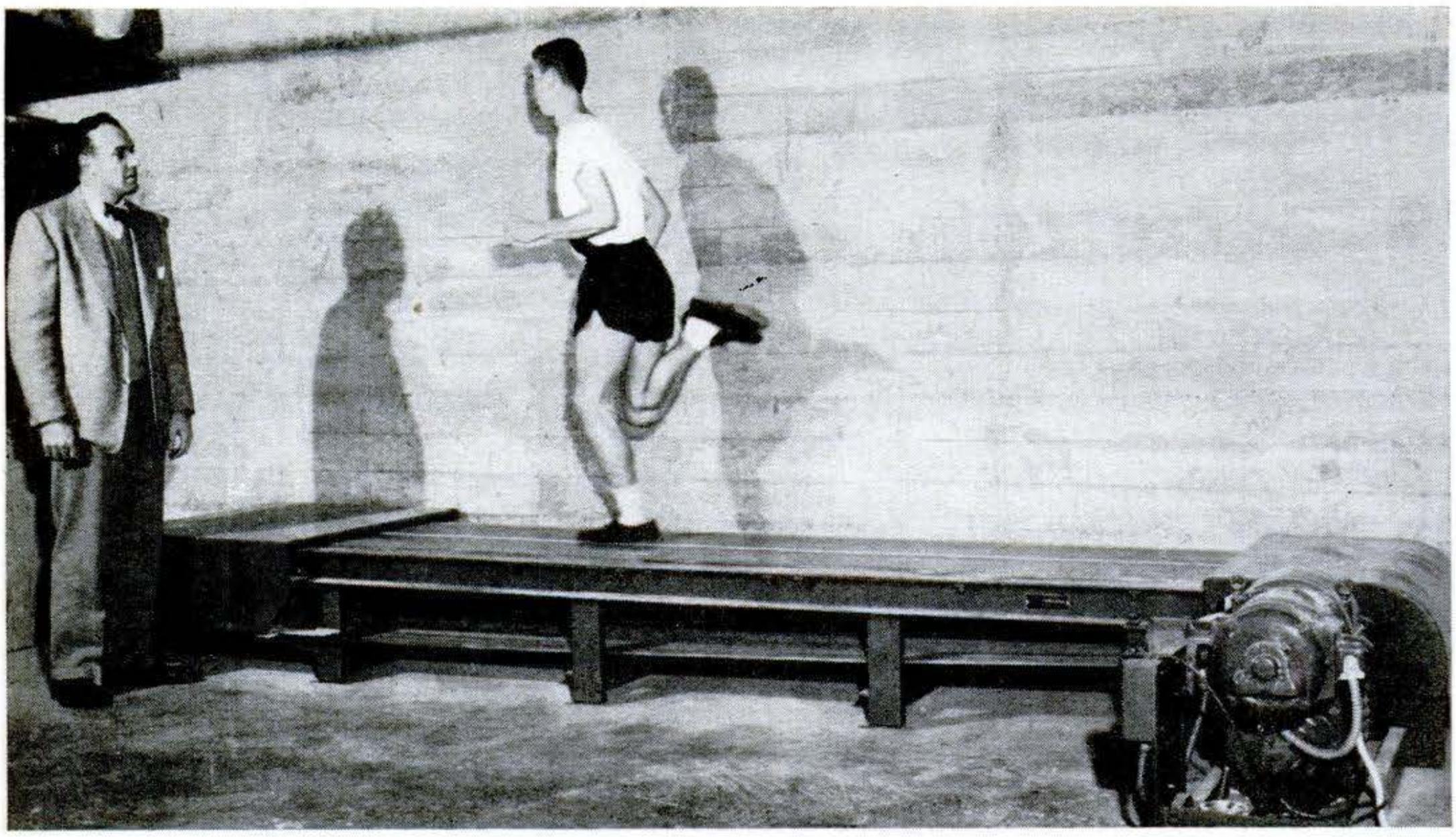
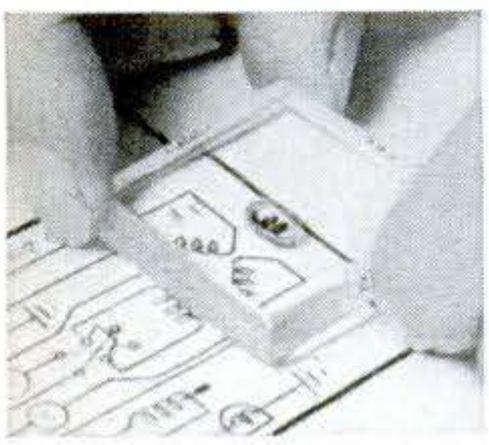


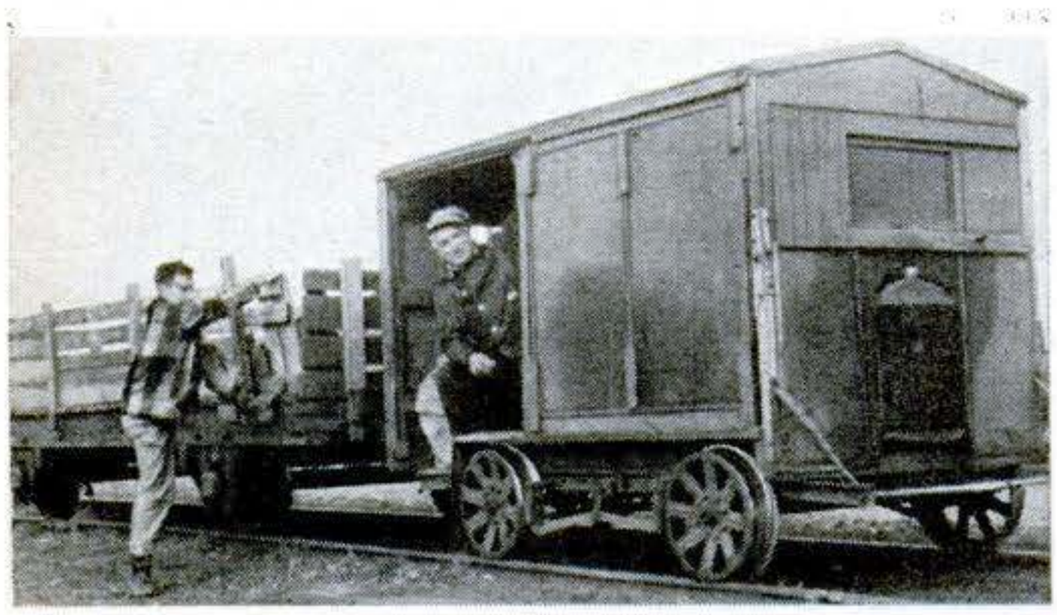
Endless-Belt Indoor Track Lets Coach Study Runner's Form

WITH this running platform, trackmen can train indoors while coaches observe running form closely. An endless belt moving at 194 to 1,320 feet a minute lets runners at Northern Illinois State Teachers College practice at any speed from a 60-second quarter-mile pace to a slow walk. Barber-Greene Co., Aurora, Ill., made the track.

Stamps Speed Drafting Work



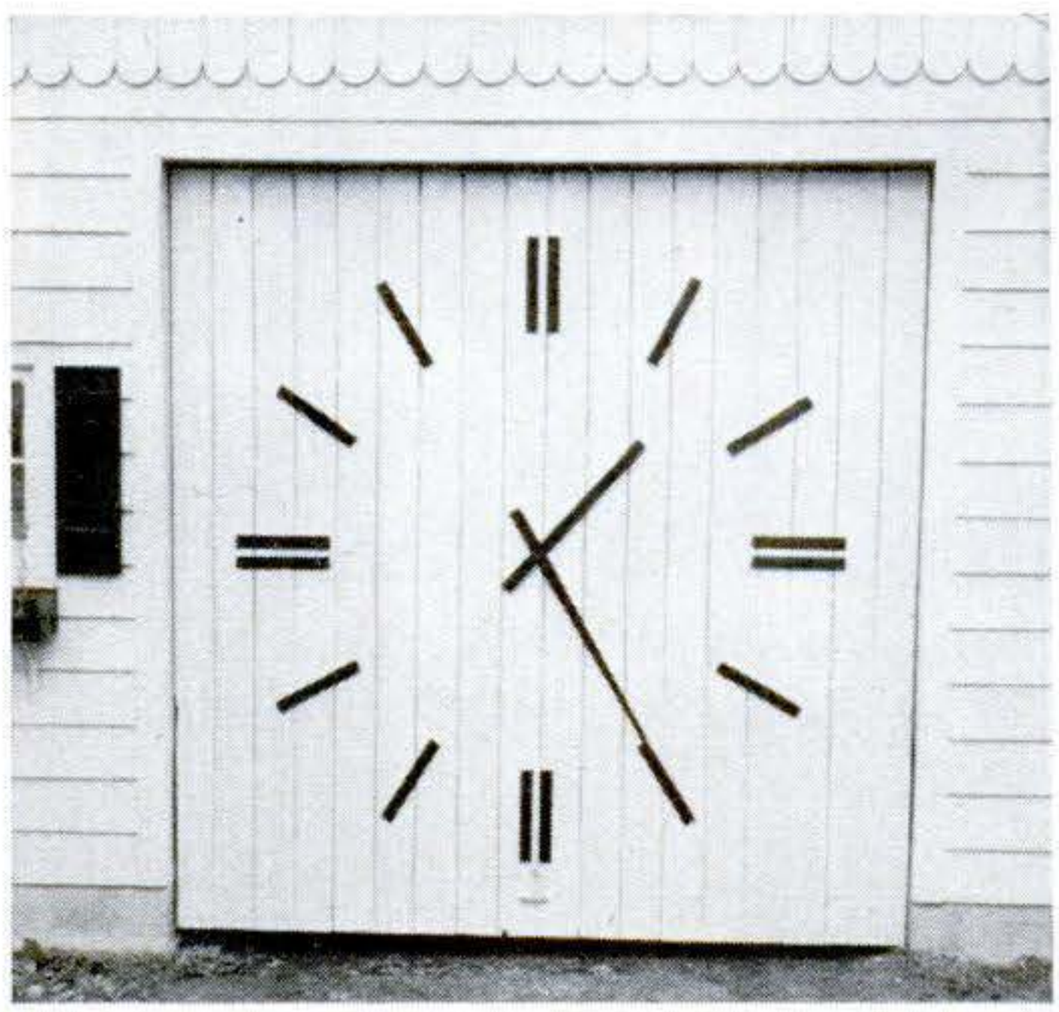
PLASTIC stamps that you can see through now speed the drafting of wiring diagrams by letting a draftsman place prints of various symbols exactly where he wants them. Called Symbostamps, they're made by John Griffin Co., 2157 James Ave., St. Paul 5.



One-Man Railroad for Woodsmen

THIS one-man jitney locomotive hauls freight and passengers in the Canadian bush. With Ford motor chugging, it rides a wavy roadbed on track laid to a now-abandoned mine. A power company runs the line.

▶▶▶Trailers are getting fancier. Half of the 1954 models have built-in TV sets, 15 percent are air-conditioned, and one out of four is equipped with a garbage disposer.



Garage Door Tells Time

AN EIGHT-FOOT clock decorates the garage door on the home of Clifford Cattell of Adrian, Mich. He says raising the door doesn't interfere with the wooden works. Yes, he's a clock designer by trade.

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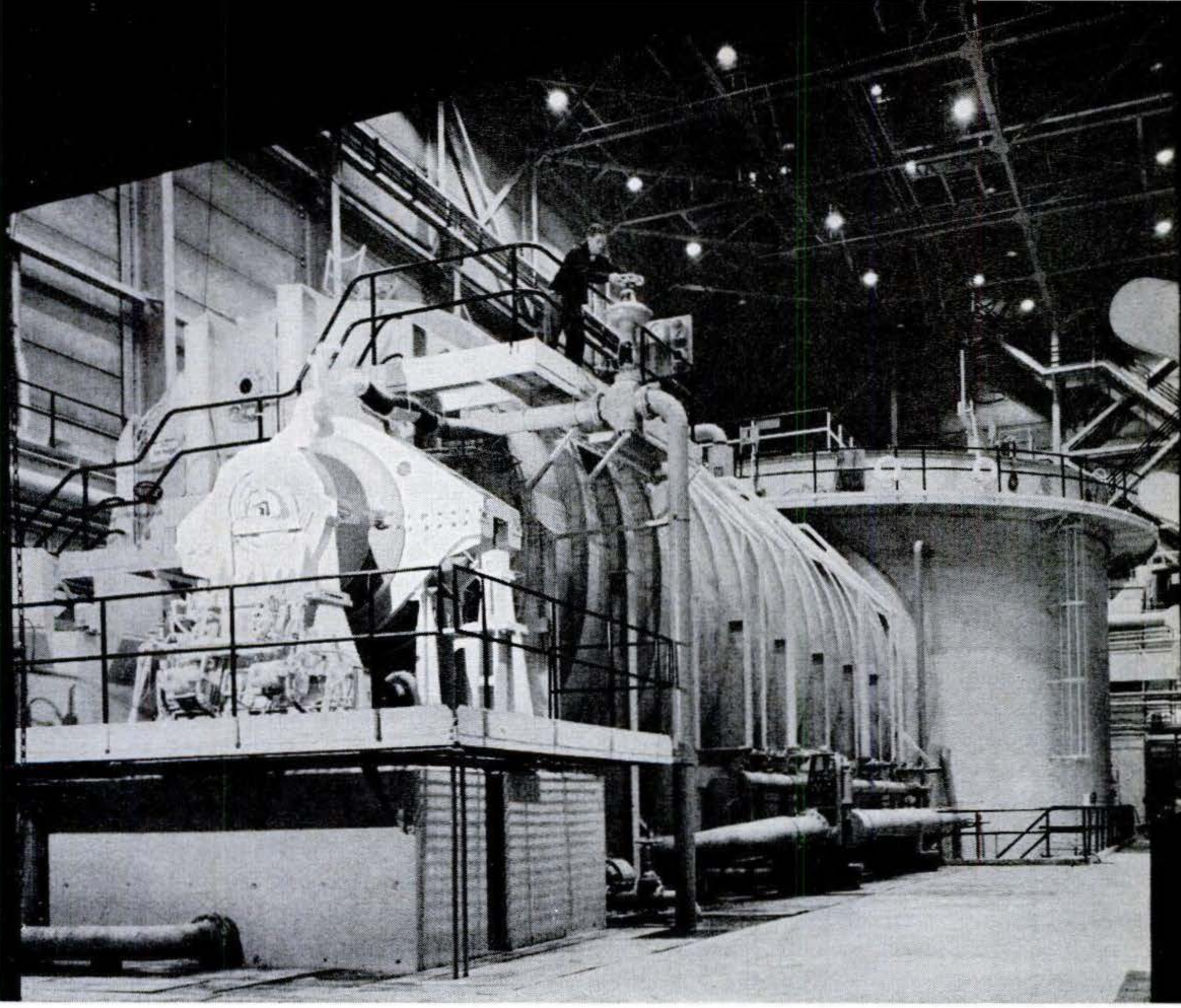

Half an atomic sub, its stern towards the door, is here "under way" in a man-made ocean.

Future Atomic Fleet Emerges from Desert

In a sand-flat test cell in Idaho was born the nuclear engine that may revolutionize all navies.

A HUNK of submarine hull in a big tank of water on a sandy plain in southeastern Idaho may well have been the most important "ship" ever built. In it, beginning early in 1951, the world's first atomic marine engine was assembled and tested. A near-duplicate of that engine powers the revolutionary new U. S. submarine, *Nautilus,* which was launched in January.

The fastest, deepest-diving sub ever known, the *Nautilus* can travel submerged around the world without refueling.

These awesome qualities, as one con-

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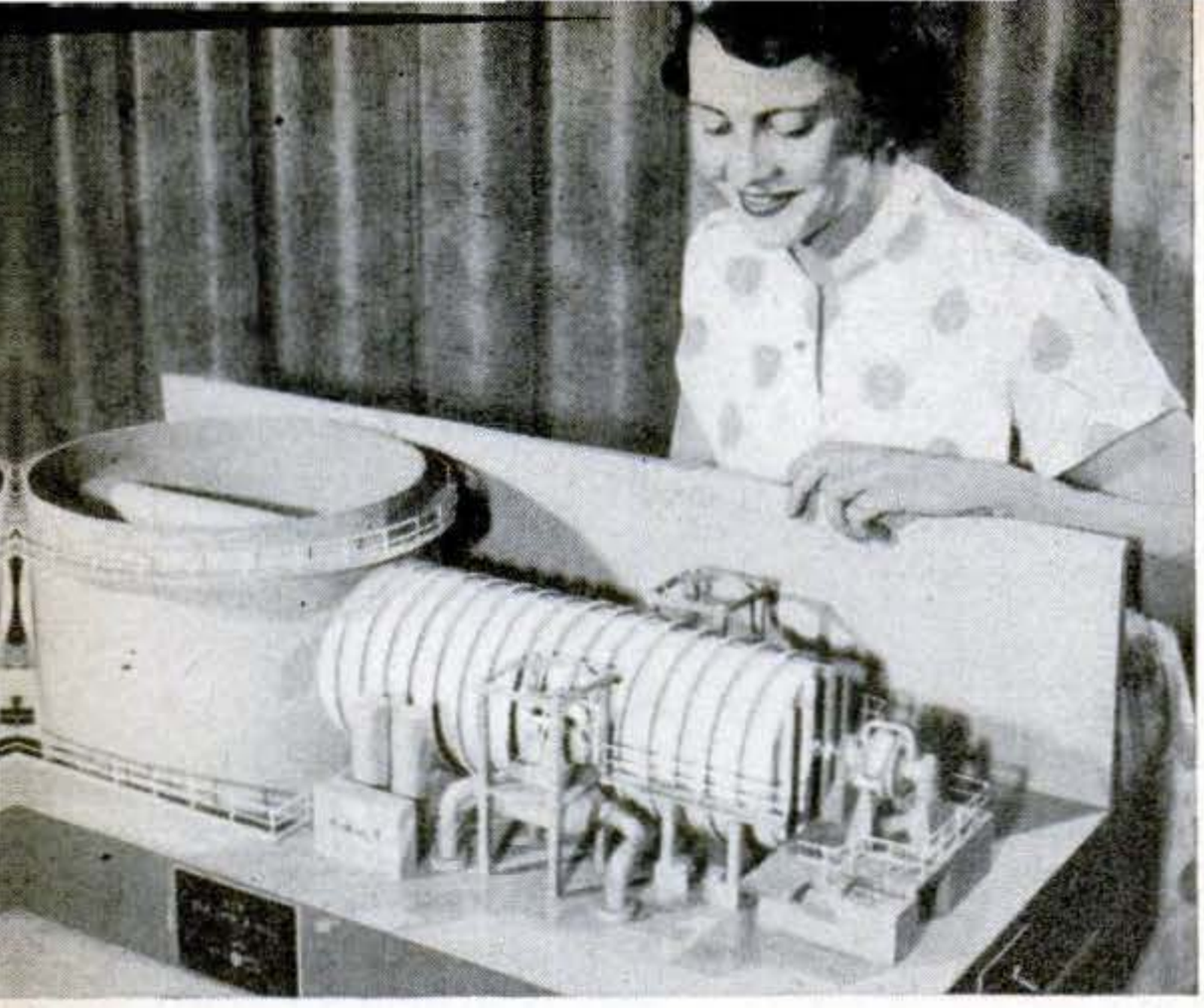
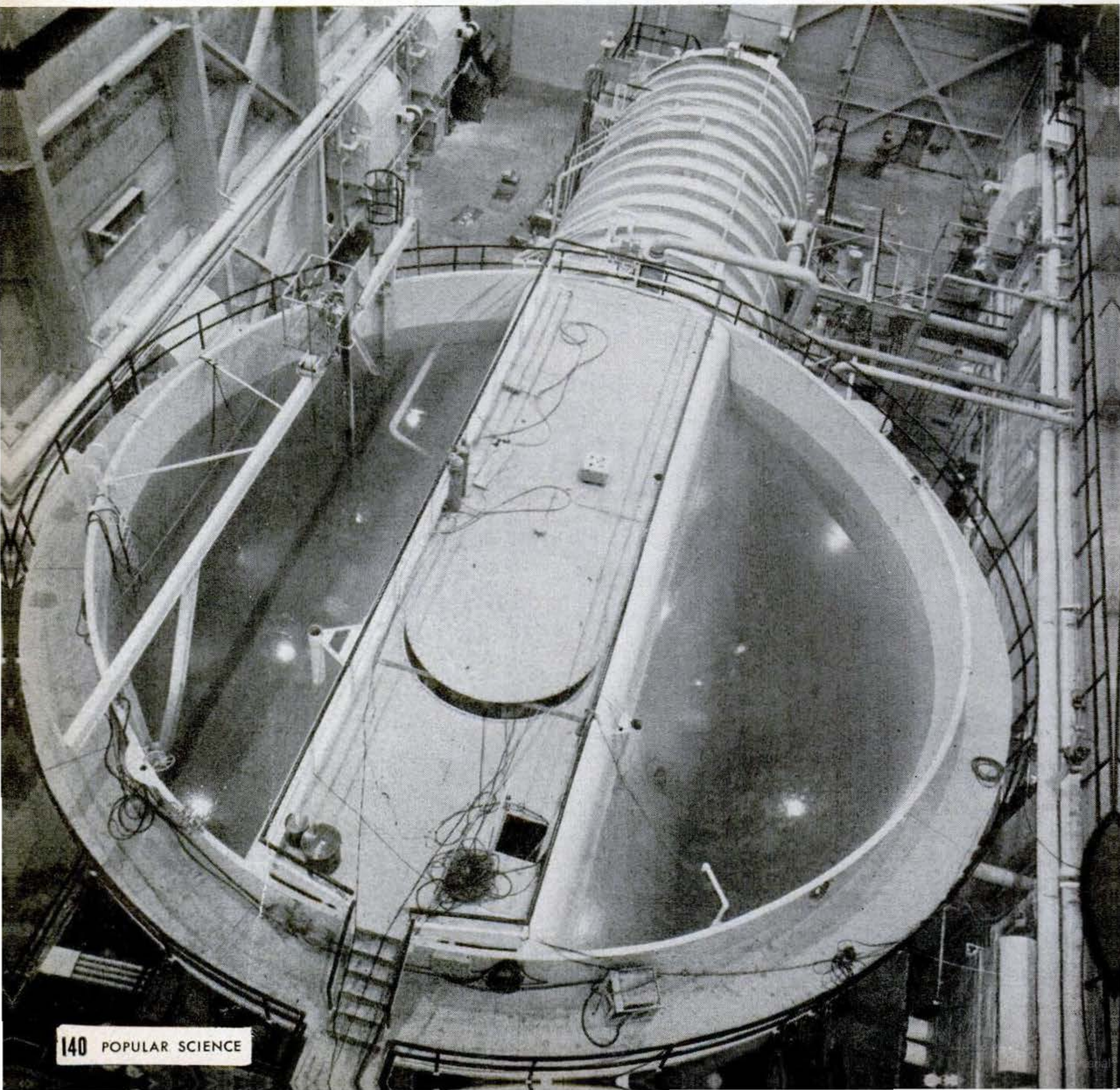


SCALE AND WORKING MODELS of the layout in Idaho where the world's first atomic submarine engine was built and tested. The tank of water below is 40 feet deep, 50 feet in diameter. In it lies the part of the hull containing the furnace that splits atoms to propel the "ship."

gressman said, may soon make the high seas unsafe for any surface vessel. They inspired Admiral Robert B. Carney, Chief of Naval Operations, to predict a future atomic fleet, all ships of which would be faster, more versatile and reliable, and cheaper to run than any ever floated before.

None of this might be possible if it had not been for the tense, dedicated work that went on for more than two years in the windowless Idaho building whose doors are opened for you on these pages.

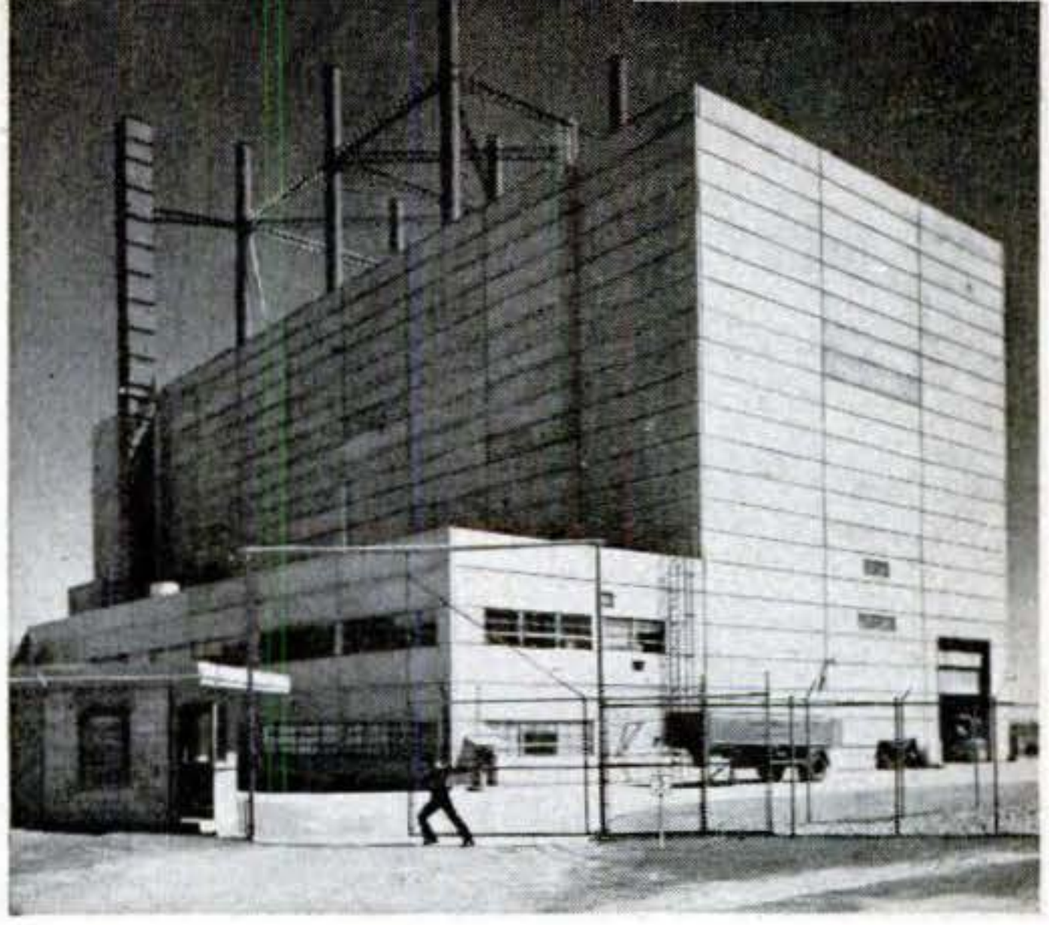
Here, without any textbooks or rules or previous experience to guide them,



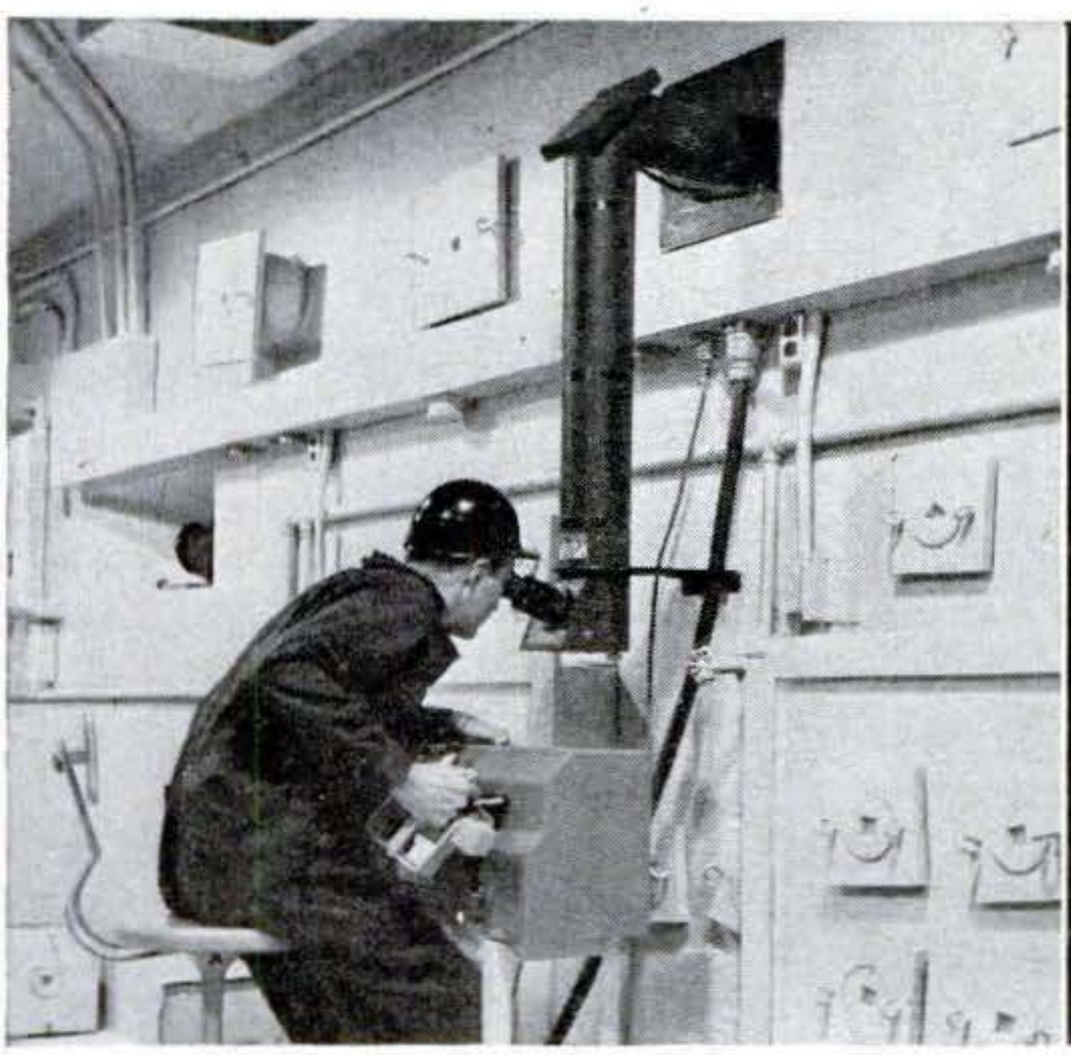
Navy and Westinghouse engineers and AEC physicists put together an entirely new type of propulsion plant—consisting of an atomic reactor, a heat exchanger and a steam turbine—and proved that it would work.

Under the zealous command of Rear Admiral Hyman G. Rickover, these men did a fiendishly complicated job in a most awkward way in order to save an estimated two years. Instead of being allowed to spread the hundreds of unfamiliar parts over a square block of floor space, and then tailoring the proven plant to fit a submarine, they were forced to do the whole task inside a steel tube less than 30 feet in diameter. Furthermore, instructions on how to proceed came from practice sessions in an exact-scale wooden mock-up 2,500 miles away.

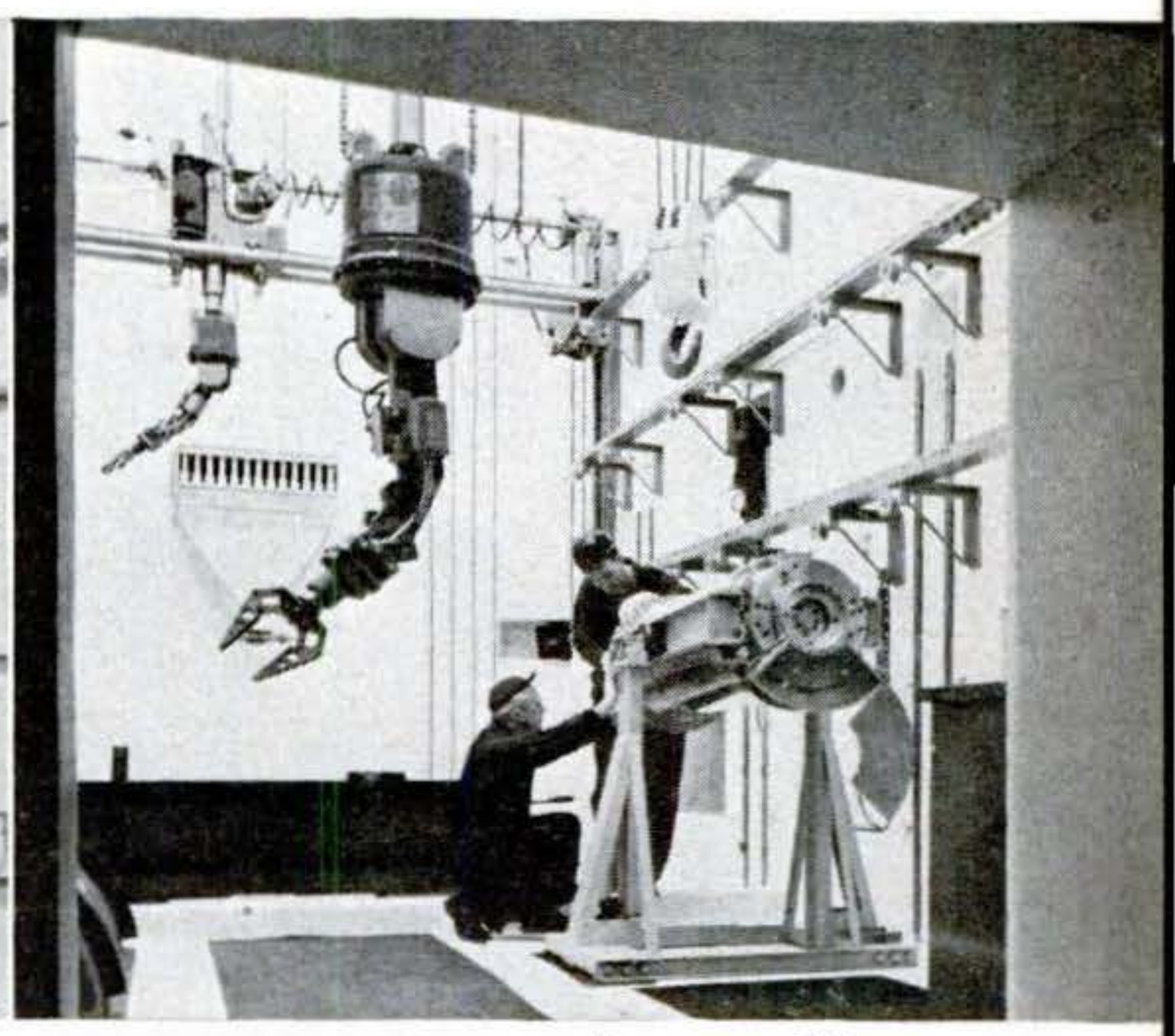
In addition, these hardy pioneers worked with a rare metal, zirconium, that could not be welded in open air without bursting into flame, and with radioactivity that was potentially fatal to them all. END



A KIND OF PANDORA'S BOX, from which fighting ships of the future will spring, is the eight-story, windowless plant where the land-based prototype of the *Nautilus* was born.

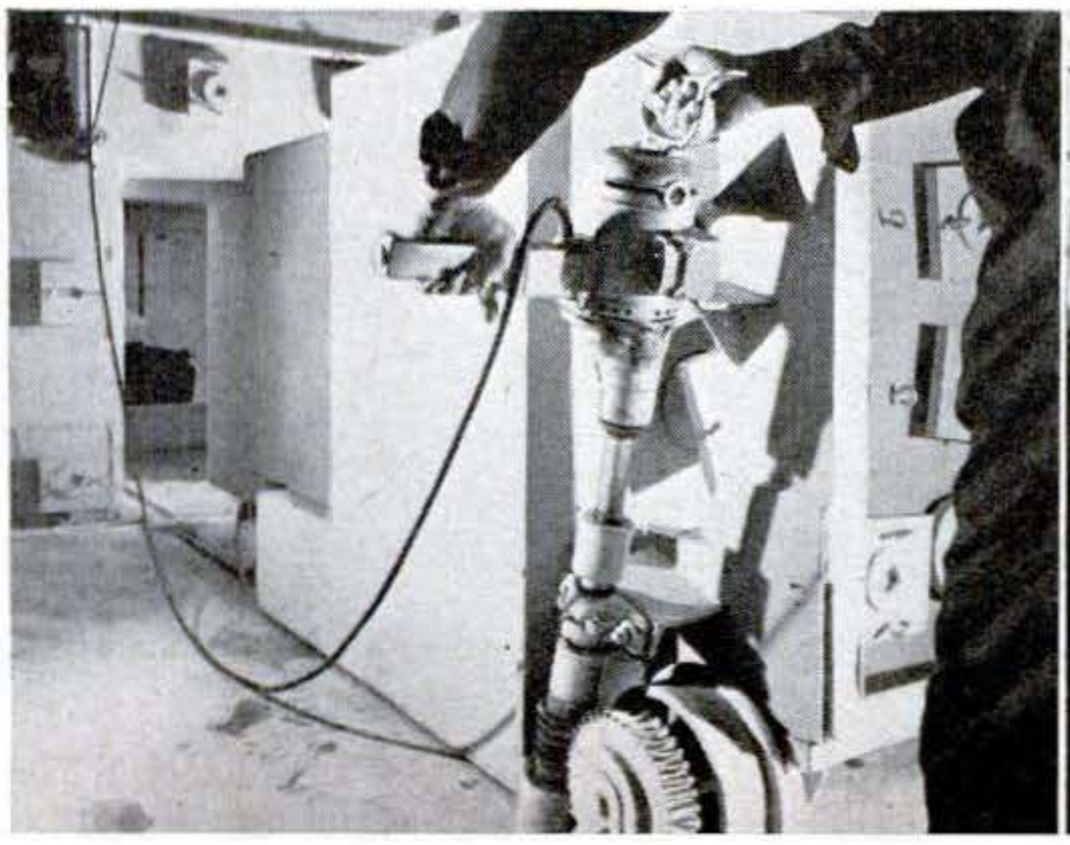


THIS PERISCOPE enables a man "handling" radioactive materials to see what he is doing.

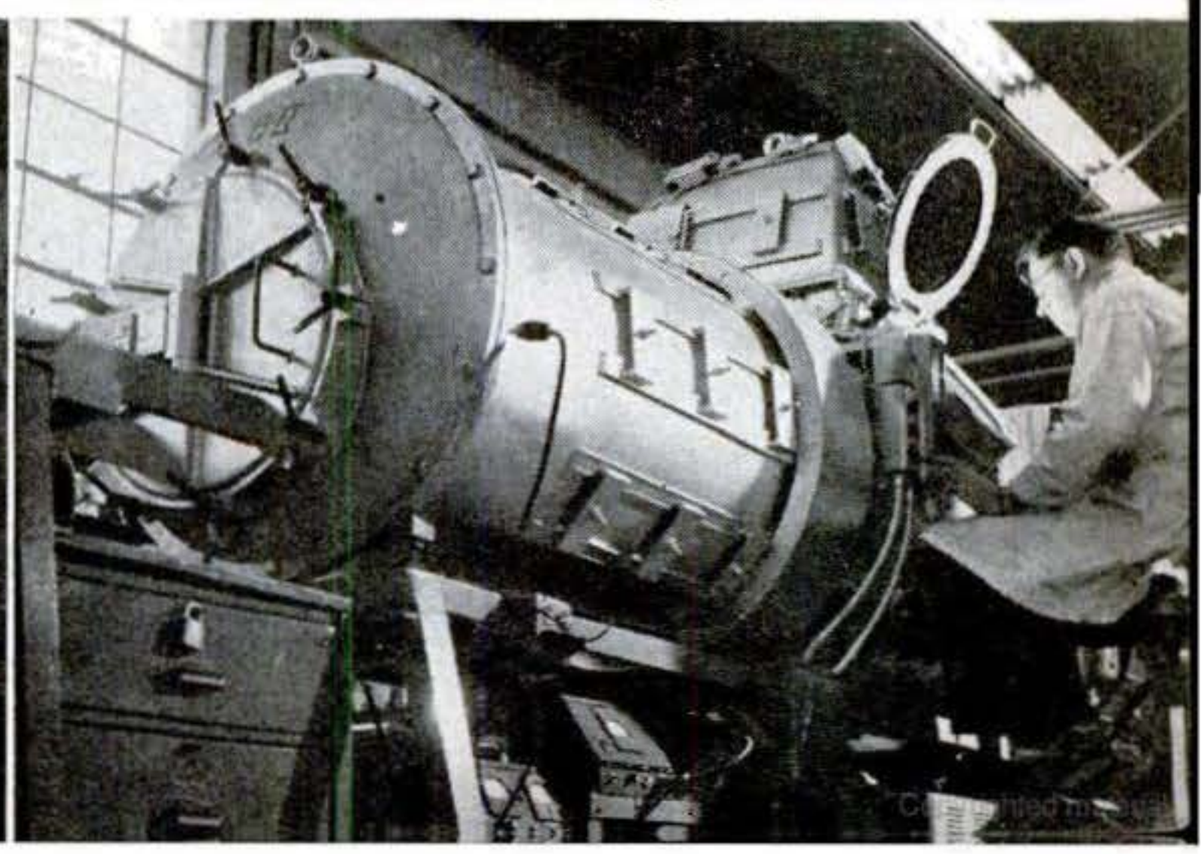


MECHANICAL HANDS, to be moved by remote control, await jobs in the plant's "hot cell."

AN ELECTRIC DRILL turns a worm drive that closes a protective door, seven feet thick.



WELDING RARE ZIRCONIUM for the sub's reactor had to be done in this giant vacuum tank.

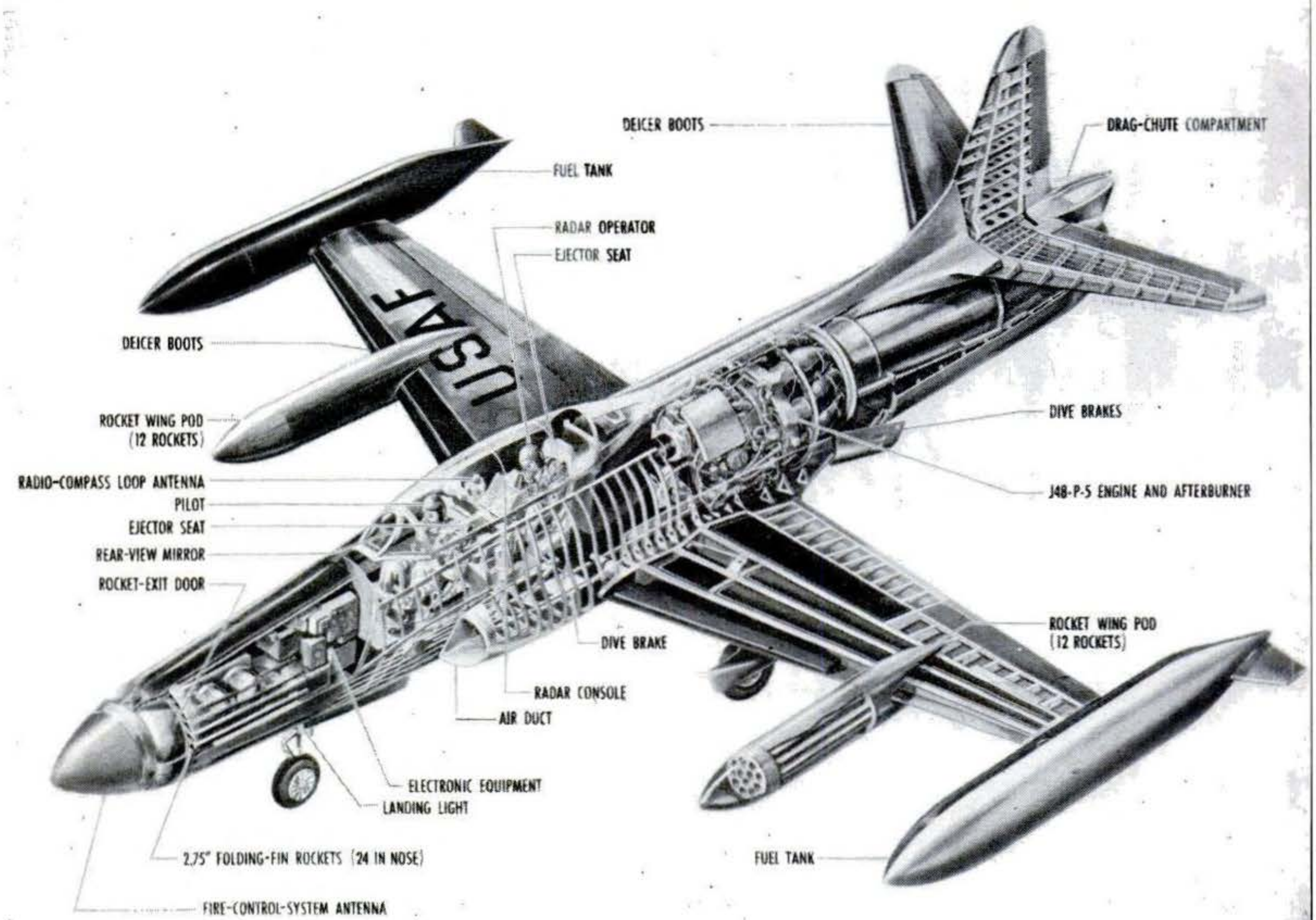


Whacks on Head Test Helmet

SLEDGE-HAMMER blows are dealt this man by a 13-pound pendulum to find out how much protection a helmet gives a pilot or football player. Instruments measure force of the blows. Result: better-built helmets.

Freezing Frees Rubber Pads

PRYING loose rubber tension pads, glued to the skin of airplanes for test purposes, used to tear the pads to bits. Now Convair engineers remove them easily after covering them with dry ice for a few minutes.



Starfire Packed with Electronic Brains and Rocket Brawn

WHAT it takes to put a top jet interceptor in the air and get its rockets away for a kill is shown in this cutaway view of the Lockheed F-94C Starfire. The more than 1,200 pounds of electronic equipment that crowds the forward half of the plane makes it all but automatic. At over 600 miles an hour, the Air Force's all-weather jet can find and knock down an aerial target its two-man crew may never see.

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Hundred-Pound Jet Copter to Lift Four Times Its Weight

THIS experimental helicopter, the Mid-jet, will fit in the average home garage with room to spare. Two blade-tip ramjet engines will speed it along at 80 miles an hour, says the Bensen Aircraft Corp., Raleigh-Durham Airport, N. C., who developed the machine primarily for military use. The engines, weighing only five pounds each, have no moving parts and run on ordinary gasoline or fuel oil.

Bail-Out Seat Rides the Rails

TELESCOPING guide rails steer this automatic-ejection seat (right) out of the cockpit, insuring that the pilot is tossed over the plane and clear of its tail surfaces when he bails out at high jet speeds. The device was developed by Lockheed for use with the F-94 Starfire interceptor.

Plane Built for Crop Dusting

DESIGNED to give the farmer more crop dusting per flight, the stubby-winged Air Tractor biplane above is shown as it taxis for take-off on its first test hop at Yakima, Wash. According to the Central-Lamson Corp., the new agricultural plane can carry a ton of spraying materials.

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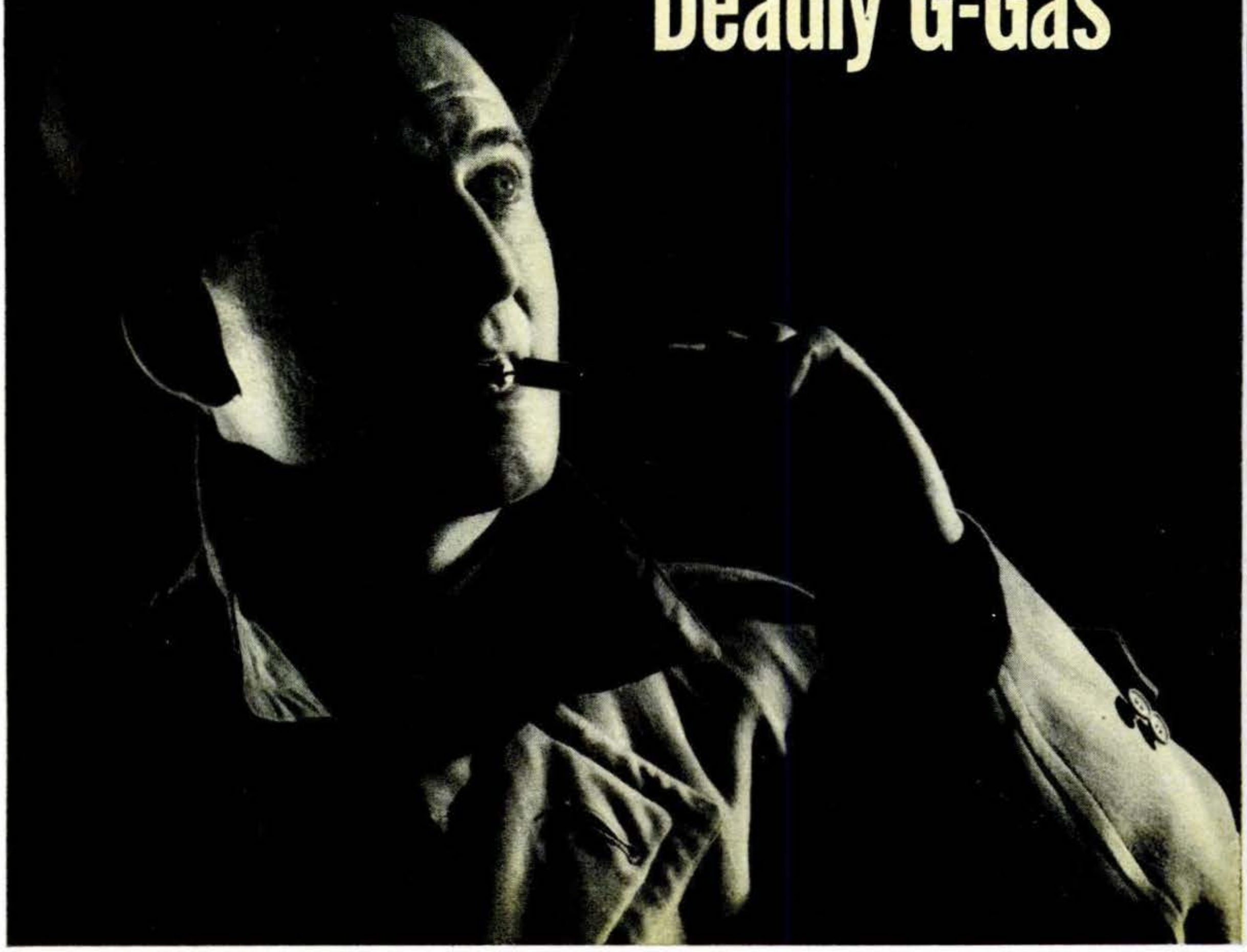
"Inventor's Inventor" designs a

Quick-Trigger Needle To Stop Deadly G-Gas



It took Yankee ingenuity—and a week's stay in a hospital —to perfect a defense against this dread horror weapon.

By Martin Mann

THE Potter Aeronautical Co., which makes airplane parts but not airplanes, is the last place you would expect to find the defense against one of the newest and most dreadful of war weapons, nerve gas. It now has some 80 employees, crowded into a dingy old building on a narrow side street in Newark, N. J. Its quarters are so cramped that a light breeze might blow chips from the lathes into the bookkeeper's ledger.

Yet from such a modest plant has come the development that can prevent the slaughter of a nerve-gas attack.

This G-gas is more deadly than A- or H-bombs, many experts believe. Odorless, cheap and easy to produce, it causes total paralysis and death within

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one minute after it is inhaled. There is an antidote: the common drug atropine. But it must be injected into the bloodstream after exposure and before that 60-second safety period is up.

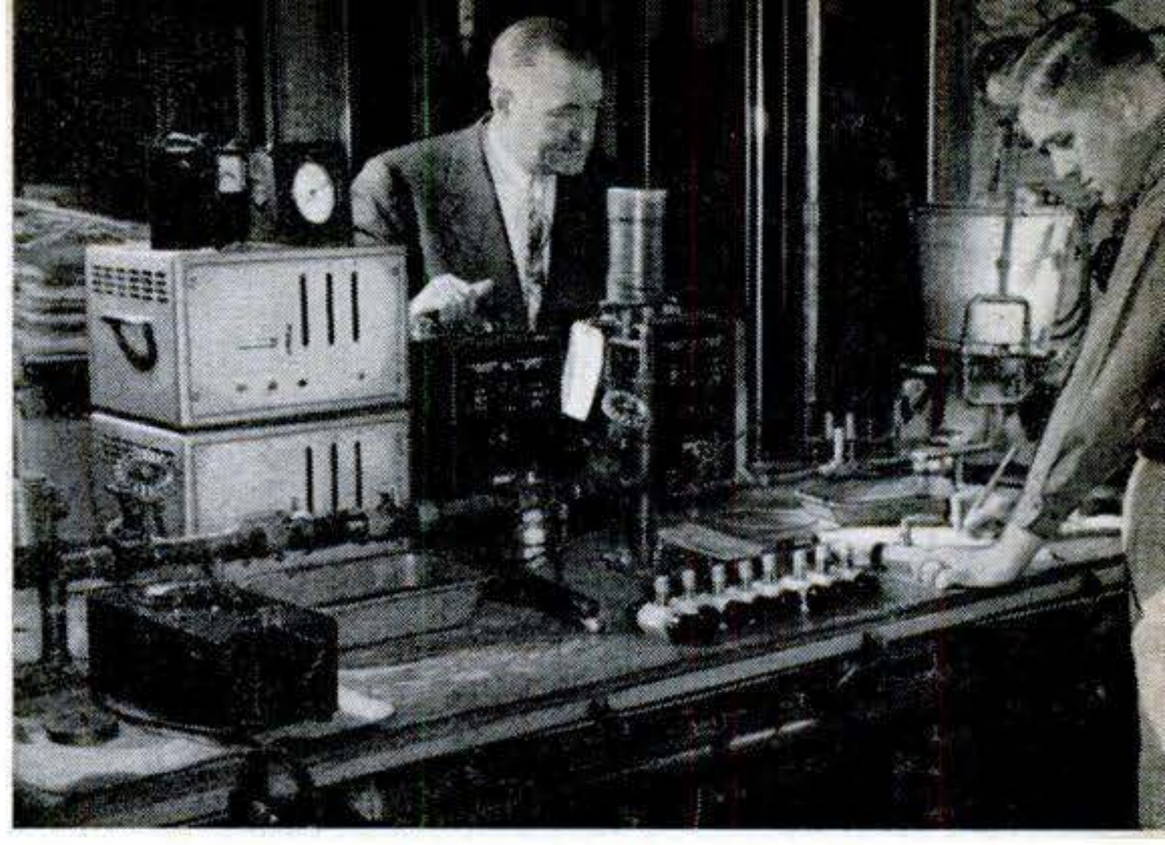
Doctors and nurses would be helpless. The only answer is an easy-to-use, foolproof hypodermic that everyone could carry with him ready to give himself a shot the instant of an attack. This is what Potter has helped to make.

Potter's injector looks like a fountain pen. You pull out the safety knob at one end (with your teeth if necessary) and press the other end against your thigh. That's all. The injector does the rest. An ingenious mechanism automatically jabs the needle through clothing and skin, then releases the lifesaving atropine. You barely feel it.

From Airplane Parts to Hypos

How come a medical item like the injector was perfected by an outfit specializing in airplane parts? In a curious way, it was perfectly natural.

The Potter company, which is now moving from its unpretentious Newark home into the magnificent new plant pictured on the next page, has been an important part of the arsenal of democracy since 1939. Its real business is invention, mostly parts and instruments for airplanes. The inventor is David M. Potter, a mechanical and aeronautical engineer (University of Michigan) with a quiet air, graying hair, sharp eyes and two Lincoln Continentals (no car crank, he just happens to like the way they ride).

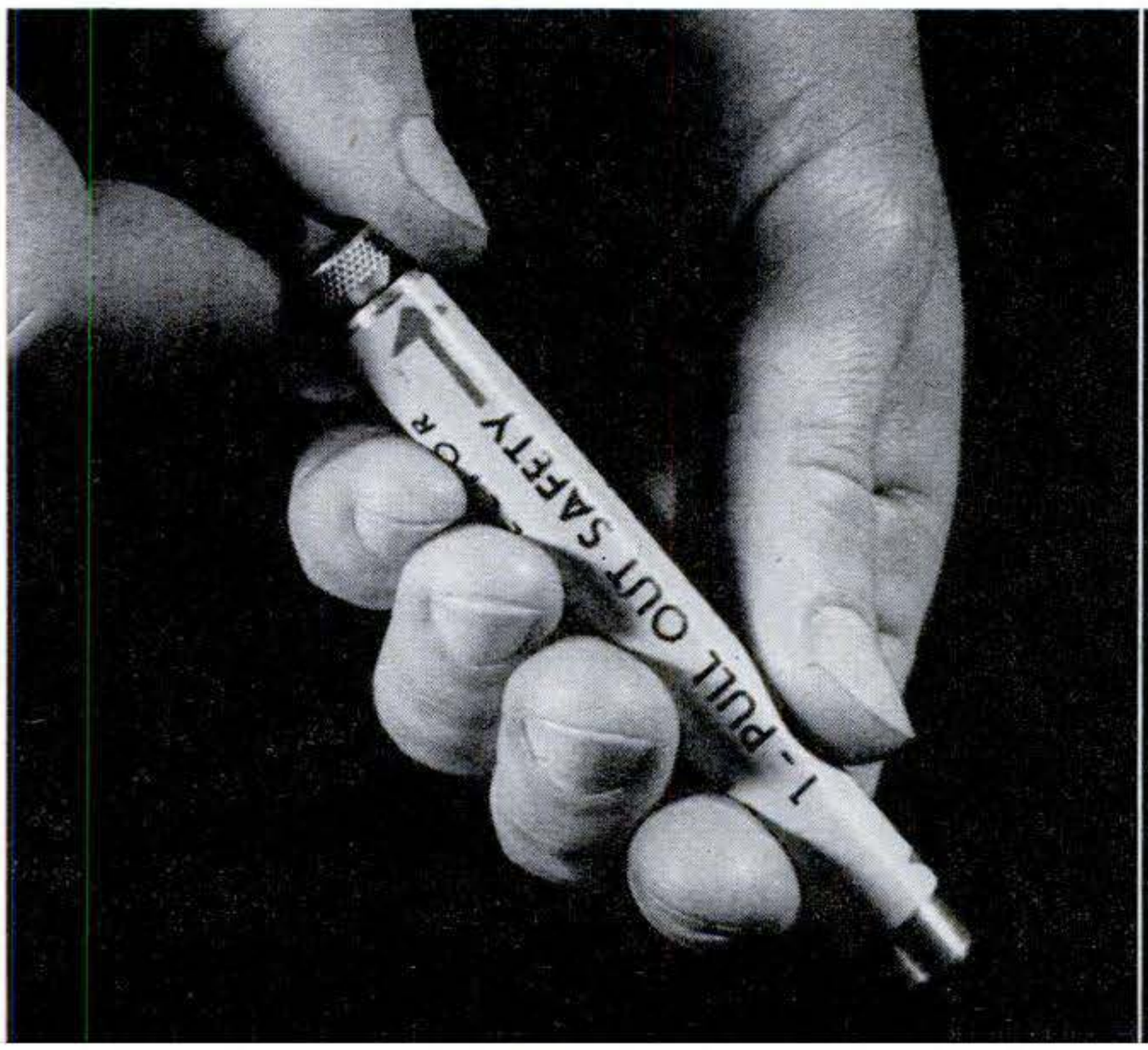


AIRPLANE AND ROCKET parts are the Potter company's bread-and-butter; medical inventions are only a side line. David Potter (center above) watches flow-meter calibration.

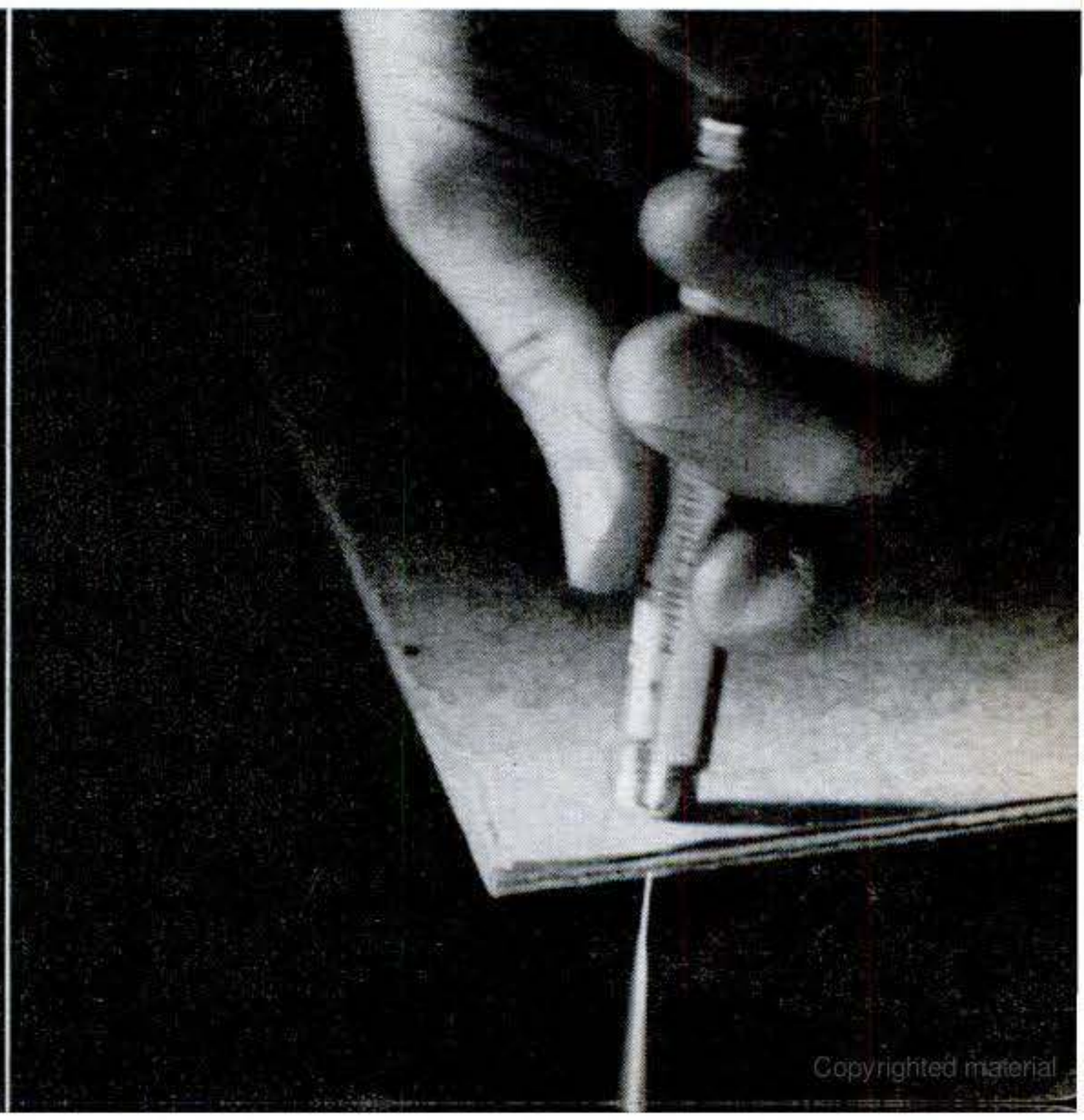
Potter served his apprenticeship with Northrop and the Navy's Bureau of Aeronautics, then struck out for himself with a new idea for measuring fuel flow.

His success story puts a new twist on the basement-workshop-to-manufacturing-tycoon fable. The workshop was a friend's. It seems the friend had a brand-new lathe and an equally brand-new baby. Potter baby-sat while he used the lathe to turn out the first few models of his flow meter.

The flow meter was a success. It is



PULL THE SAFETY is first step in using automatic injector to protect against nerve gas. Pin, which prevents accidental firing, can be pulled with teeth if arm is injured.



PUSH THE INJECTOR—preferably against thigh—to shoot needle into body and release lifesaving antidote, atropine. Injector can work right through heavy winter clothing.

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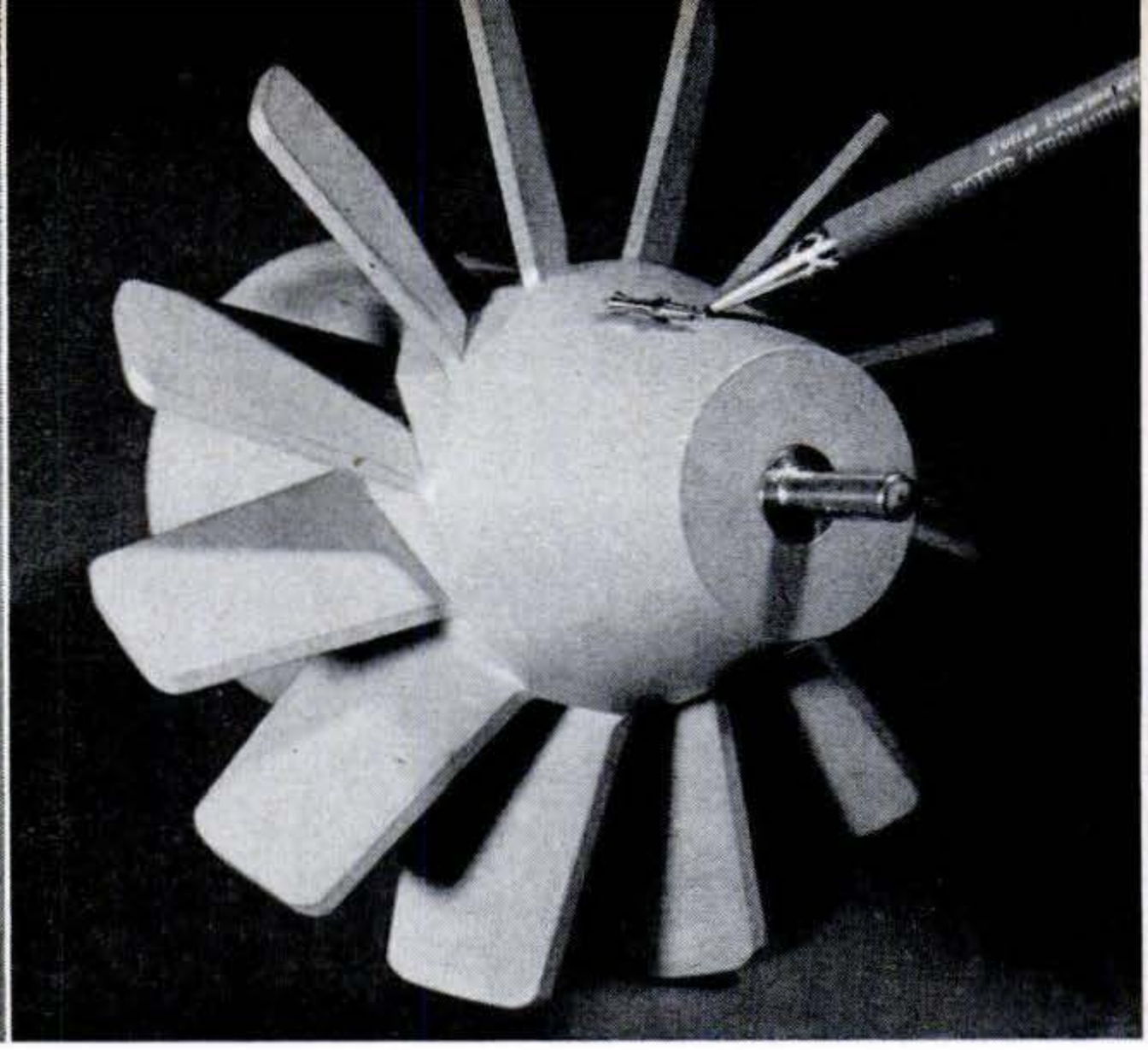
SECURITY isn't overlooked in the design of the new plant Potter is now moving into. Concrete walls protect bombproof underground storeroom. Passage (rear) is bomb shelter.



POTTER GOT HIS START by inventing flow meter. Large turbine above measures fuel flow in rocket, while tiny one resting on it is similar to meter designed to gauge flow of blood.

now used in U. S. jets and rockets, forms the mainstay of the Potter company's business, and enables Potter to support his Continentals in comfort.

Its reputation eventually reached Dr. Stanley J. Sarnoff, Associate Professor of Physiology at the Harvard School of Public Health and a leading expert on blood circulation. Dr. Sarnoff wanted to measure the flow of blood and he came to Potter for help. Potter made him a small flow meter that could be sewed up inside a dog.

Dr. Sarnoff later became involved with G-gas, specifically with the automatic-injector problem. He and his wife Charlotte spent two years designing 30 models. None worked too well.

Late one day last year, Dr. Sarnoff dropped in at the Potter headquarters. "I noticed how tired and discouraged he looked," Potter reminisces, "so I asked him, 'What's the matter, Doc?' "

Dr. Sarnoff explained that he had spent a frustrating day trying to interest people in a difficult, vitally important problem. Then, knowing that Potter and his associates were cleared for classified information, he told them something of the still-secret G-gas and outlined the injector problem.

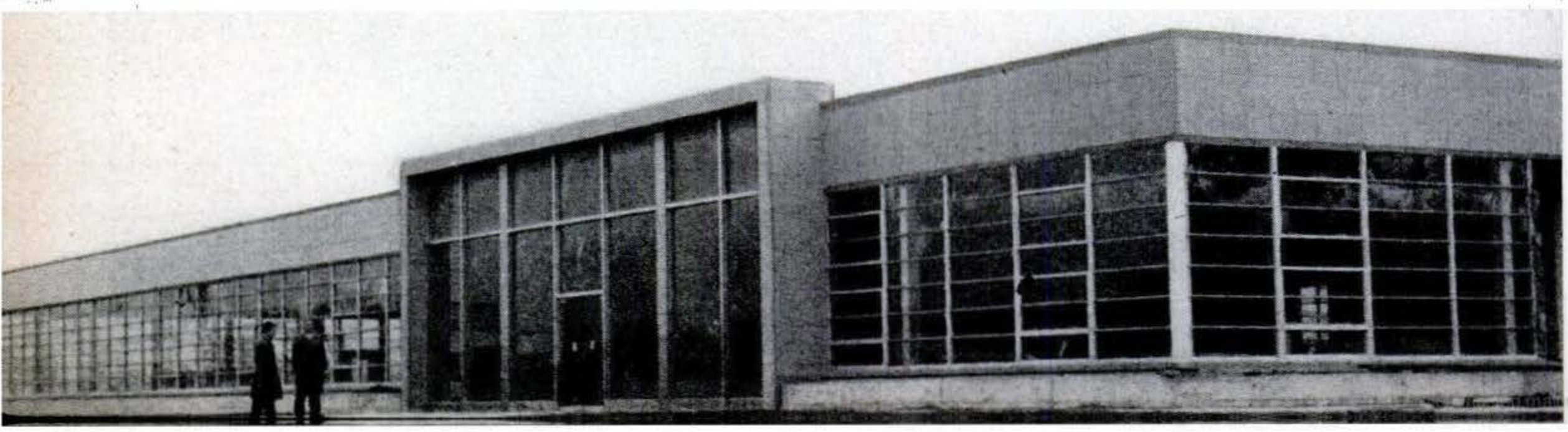
Secretary to the Rescue

"We were all impressed," Potter says. "They were getting 40 percent rejections on their injectors. That means an attack could kill 40 people out of every hundred. But when the Doc suddenly asked us to work on one, Hirsch—the business brains of our outfit—broke in. 'Throw the Doc out,' Hirsch said. 'Every time we do a job for him we lose money.'

"Well, that's true. But we had a secretary then, name of Kathleen Ruch; she was a sort of company conscience. I

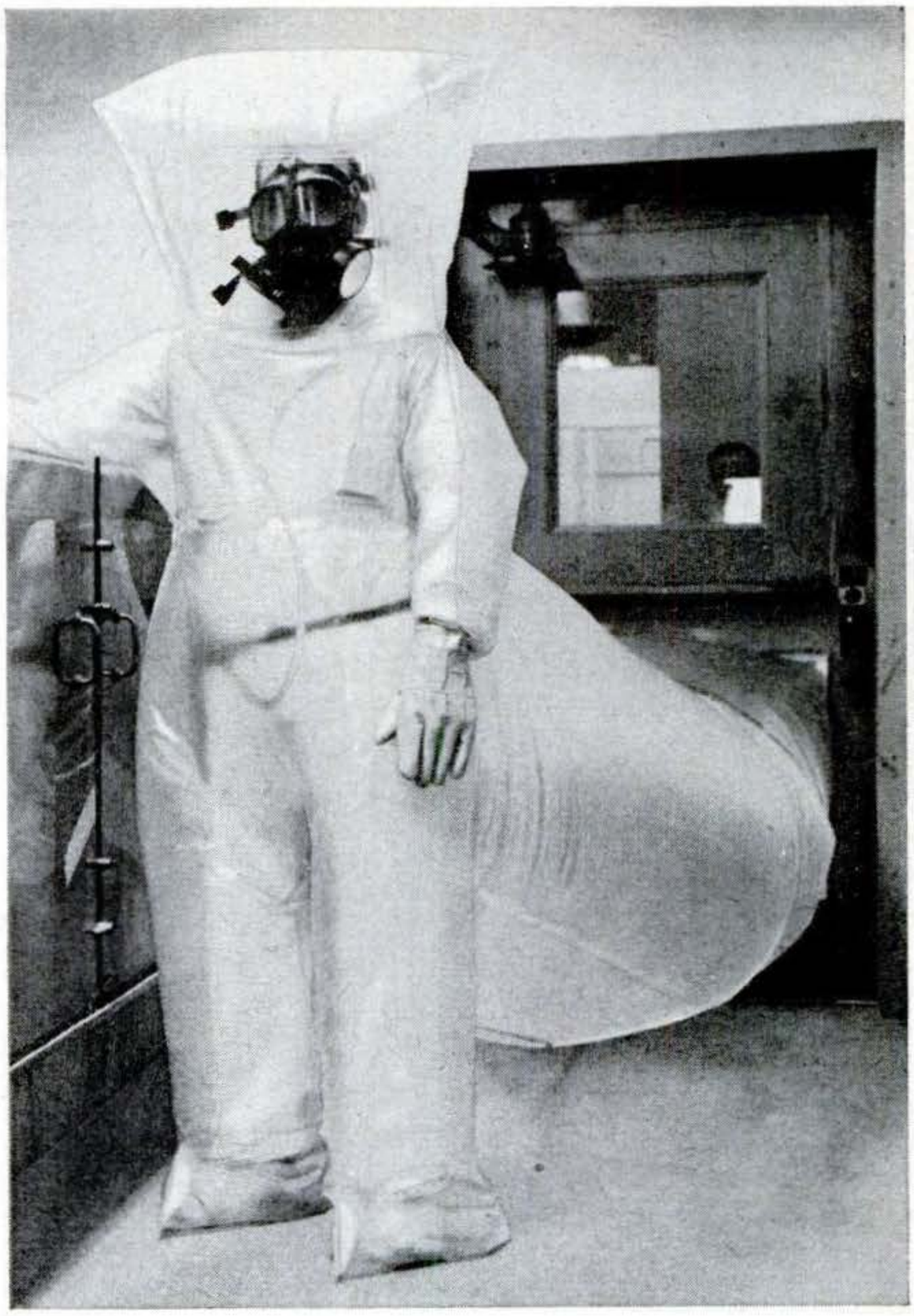
[Continued on page 274]

MODERN, GLASS-WALLED plant in country setting is indication of inventor Potter's versatility. He designed buildings and supervised construction, serving as his own contractor.



Tail of "Hot" Suit Serves as Entrance

A TECHNICIAN puts on this plastic protective suit by crawling into it through its fat "tail," which is connected to a port in the door. Used in radioactive areas at the Hanford plutonium factory, it stays inflated because air pressure inside the "hot" room is lower than pressure outside. This prevents any radioactive dust from leaking outside the room.



Trolleys Get Music

PULL on the strap in a Milan trolley car and you hear music. There's a tiny radio loudspeaker above the lady's hand. It is connected to a receiver near the driver's seat. Presumably you can let go when it's time for the commercial.

Refrigerator on Wall Insulated by Vacuum

YOU may be able to buy a no-stoop refrigerator like the one at right by next fall. It has vacuum insulation—10 times more efficient than insulation now used—in back, bottom and doors. This helps make it only two-thirds the size of GE's conventional 10-cubic-foot models. Estimated price: $800 to $900.

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Magnetic Clutch Challenges

Lightning-fast and sensitive, this exciting new drive runs on a handful of powder. But it feels like an oily hydraulic.

By Frank Rowsome Jr.

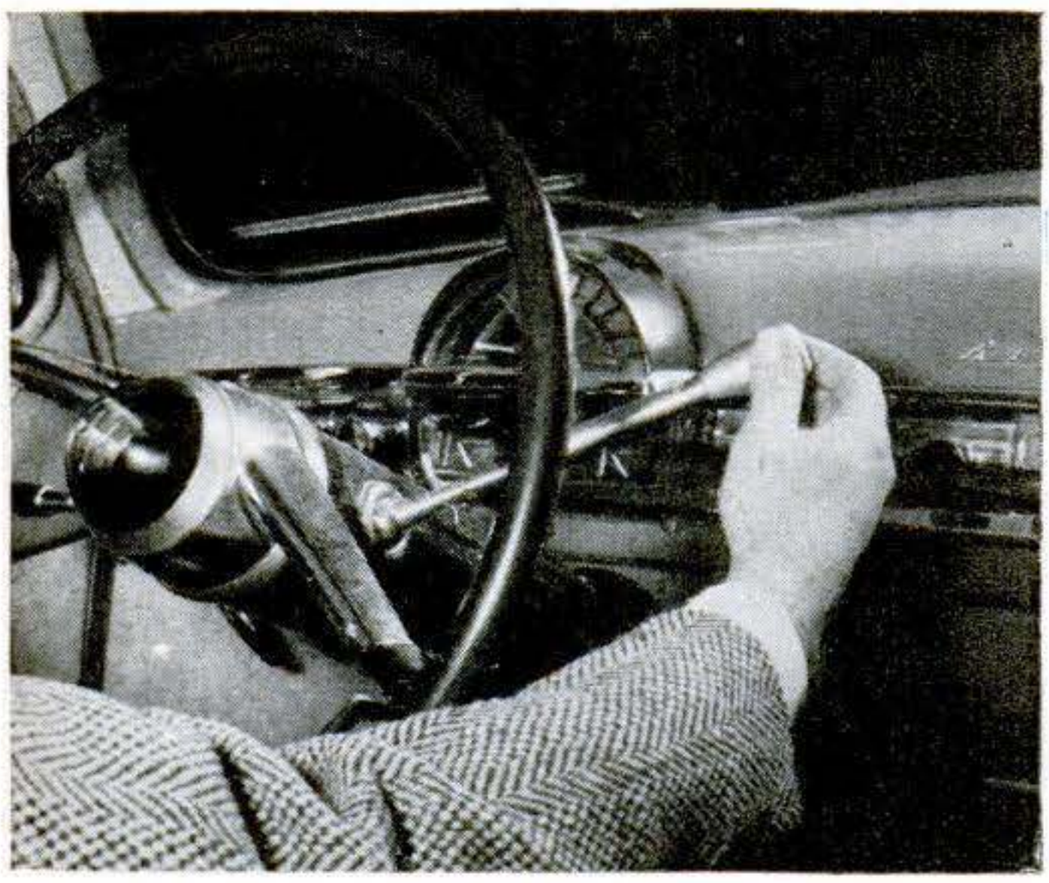
IT SEEMED like a common or garden Ford sedan. The plastic shift quadrant above the wheel did look unusual, as though it had been handmade by a machinist. (It had.) Otherwise, the car appeared to be as stock as a Ford can get.

Appearances, though, were dead wrong. Under the floor was an exciting new transmission, entirely different from the intricate hydraulic boxes that are abroad these days. It used two new magnetic-powder clutches—simple but remarkably able devices that may revolutionize U.S. automatic transmissions.

None of the internal wonders were evident when, a few weeks back, I was invited to be the first magazine writer to try out this long-rumored new drive. With the engine idling, I pulled the selector lever to D_3. Howard Findley, research engineer for Eaton Manufacturing Company, the big auto-component maker that is developing the new drive, explained that D_3 meant the transmission would run from low through second to high.

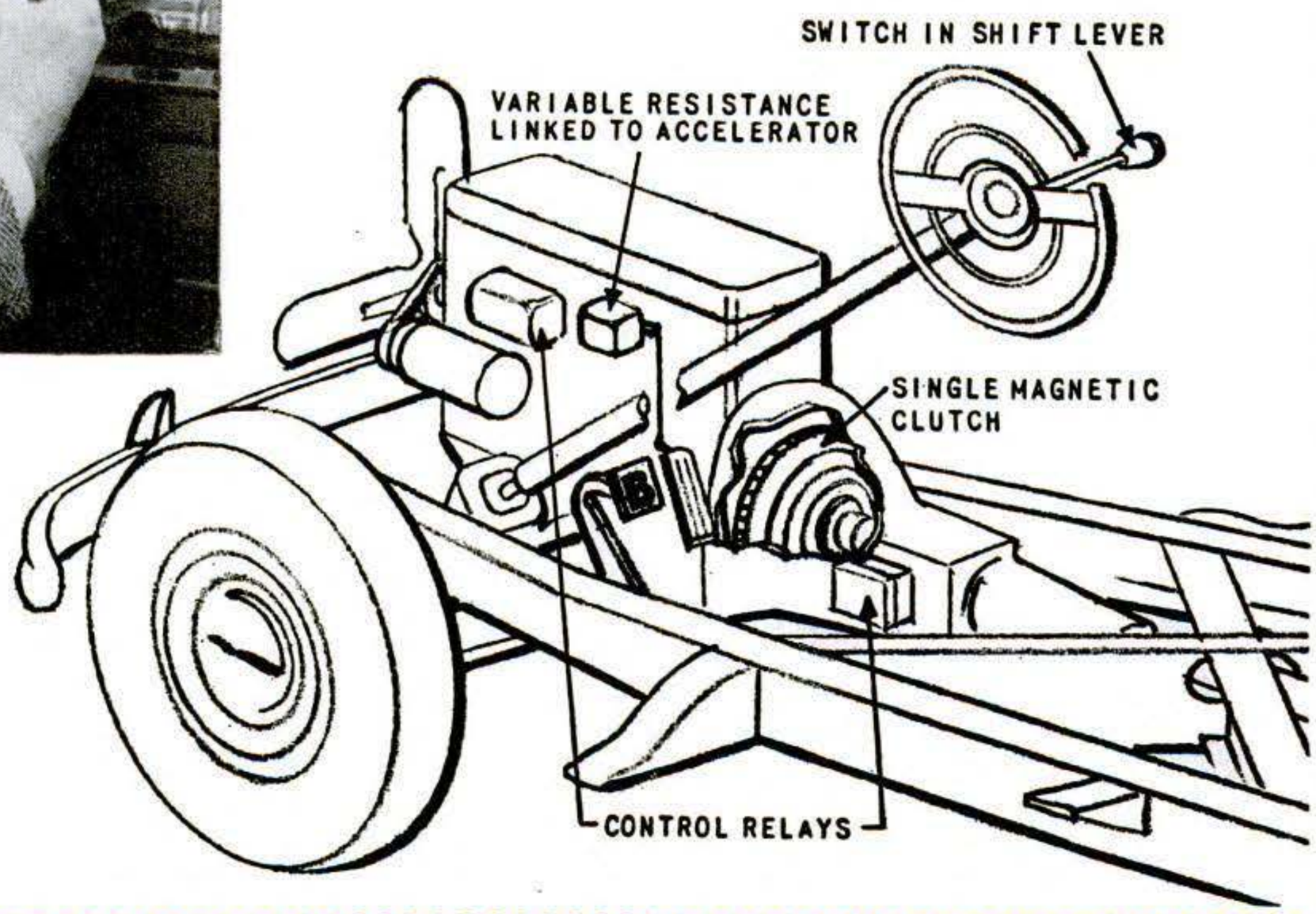
"If you put it in D_2," Findley said, "you go straight from low to high. This is a standard three-speed box—or was until we reworked it and threw out a lot of the original parts."

Not creepy. Right away you notice one difference. When you put an ordinary automatic in Drive, there is a subterranean *ka-chung* to tell you the plumbing is ready, and a kind of false eagerness in the box, otherwise known



"POOR MAN'S AUTOMATIC" is what Eaton engineers call this experimental job in a Nash. It is really a semiautomatic drive, using one magnetic clutch ahead of a standard gearbox. Touching shift lever disconnects clutch instantly; pressing gas pedal engages it gently. You can't stall engine even by starting up in high, for clutch eases up if a stall threatens.

How it works:



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Automatic Transmissions

as creep. This Eaton job has no such tricks; in D_2 or D_3 at idle it is completely passive.

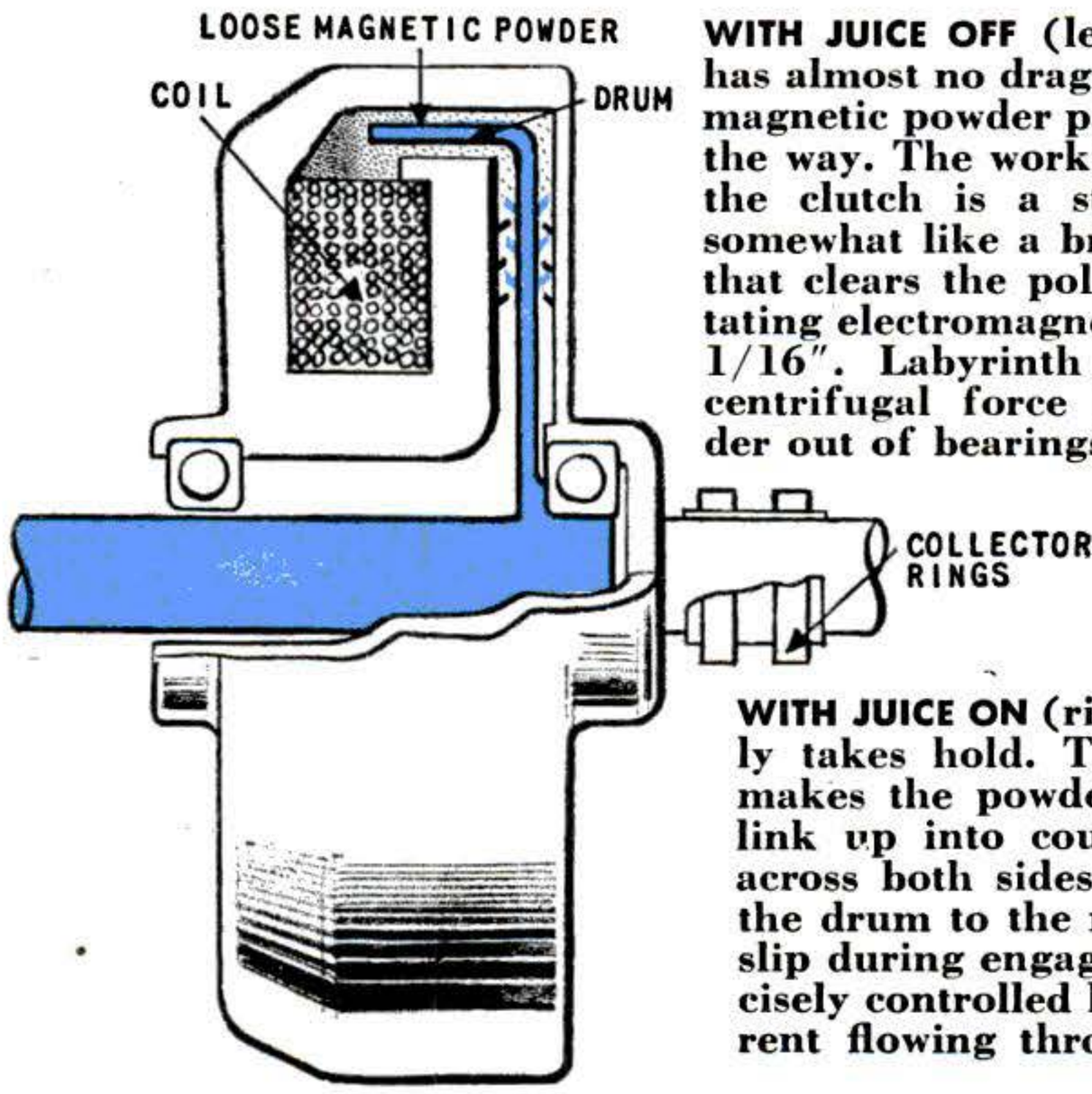
There was no clutch pedal. When I touched the gas, we got going quick and easy. The best way to describe take-off is to say it's like that produced by an expert driver in a manual-shift car that he knows well—no mush and no jerk.

I tried it at different throttle openings, and each time it was as though there was a talented midget under the floor who was skillfully working a friction clutch. At a few hundred revs above idle he eased the clutch in gradually; with more gas he cut down on slip time; if you tromped, he worked fast, just short of a jerk. There was a conspicuous lack of that syrupy, all-in-good-time way that most automatics get rolling.

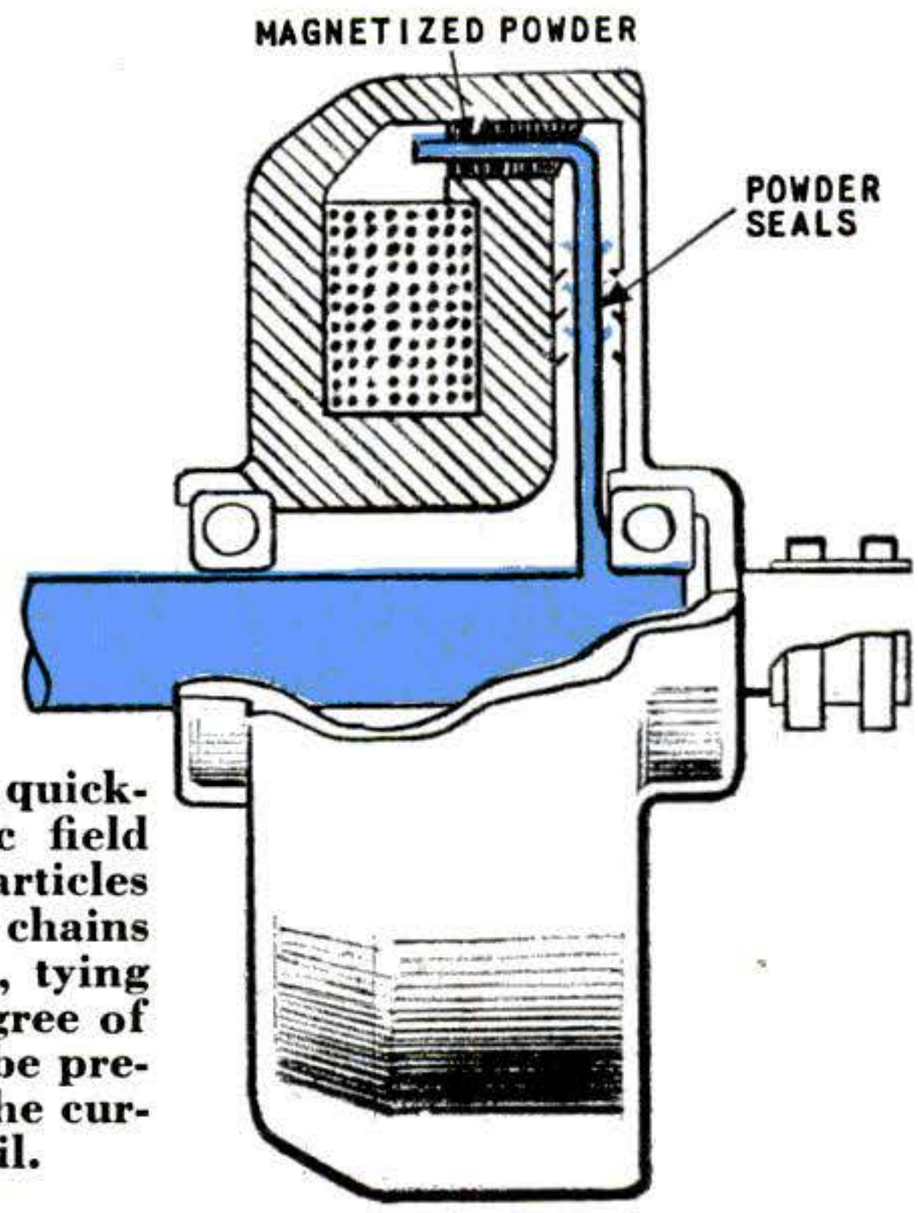
Secret shifts. The upshifts, too, were impressive. I'd be accelerating at eight or 10 miles an hour in low, when I'd suddenly discover I was really in second. Presently the same sleight-of-hand would occur and presto—we'd be in high. I could spot the shifts only by the difference in revs, *after* the shift had taken place. There was no internal hiccup in the box, and no discontinuity in torque that I could feel.

On the highway, this automatic gave the impression, lacking with many of the others, that the engine had a close, friendly relationship with the drive shaft. There was none of that formal meeting in swallow-tailed red coats for a polite discussion of what ratio seemed appropriate for the occasion. When you hit the gas, the engine hit the wheels; when you backed off, the engine dragged.

No convulsion. The only time it wasn't entirely smooth was when I floorboarded it at around 25, kicking down from high to second. This produced a mild but perceptible hesitation; it takes a little slice of time for an engine to rev up to match a new ratio. The kickdown did not, however, even approach the theatrical convulsion that some automatics display on a high-torque downshift. And when you drifted up to a red light with your foot



WITH JUICE OFF (left), clutch has almost no drag; the fluffy magnetic powder packs out of the way. The working part of the clutch is a steel drum, somewhat like a brake drum, that clears the poles of a rotating electromagnet by about 1/16″. Labyrinth seals and centrifugal force keep powder out of bearings.



WITH JUICE ON (right), clutch quickly takes hold. The magnetic field makes the powdered iron particles link up into countless tiny chains across both sides of the gap, tying the drum to the magnet. Degree of slip during engagement can be precisely controlled by varying the current flowing through the coil.

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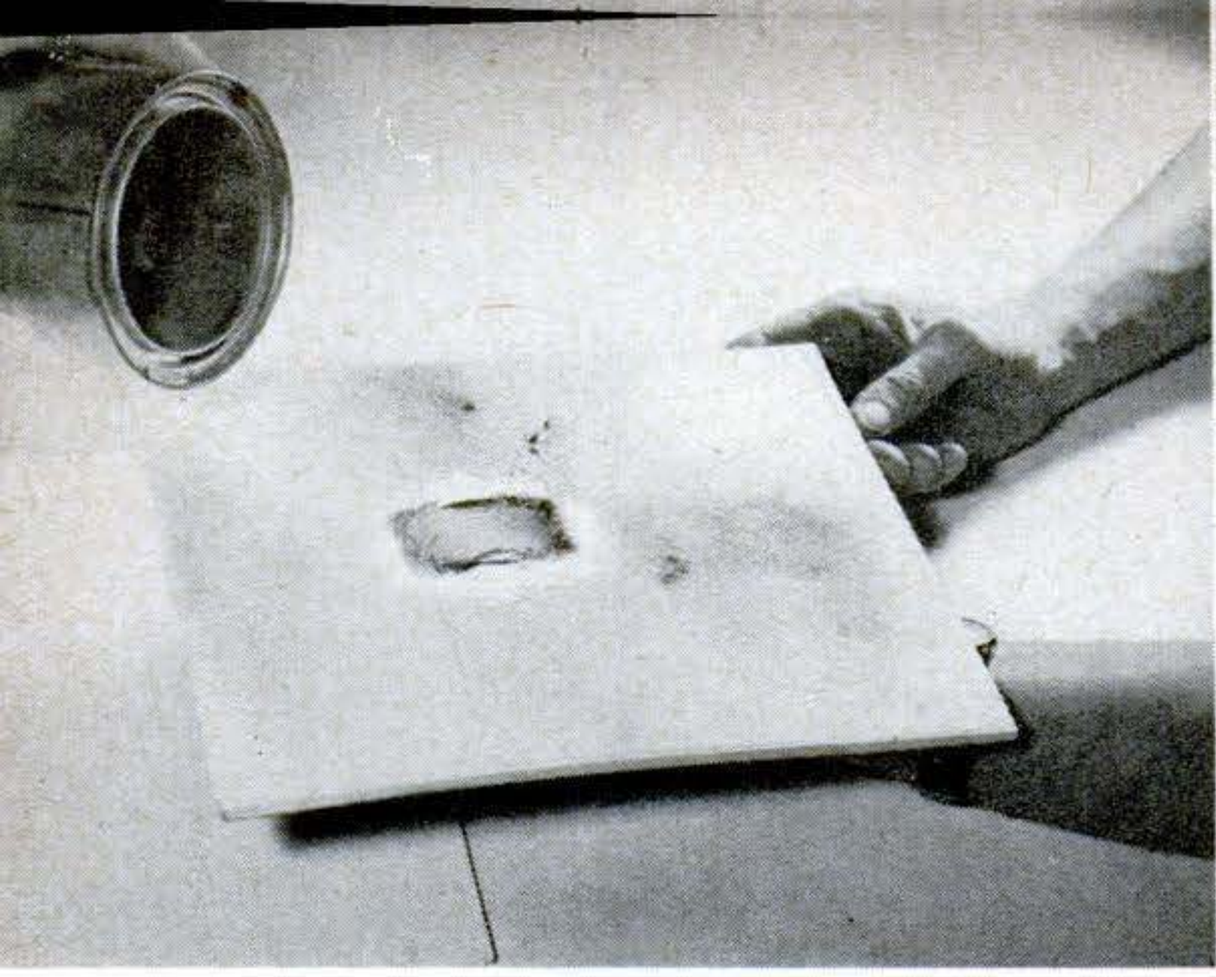
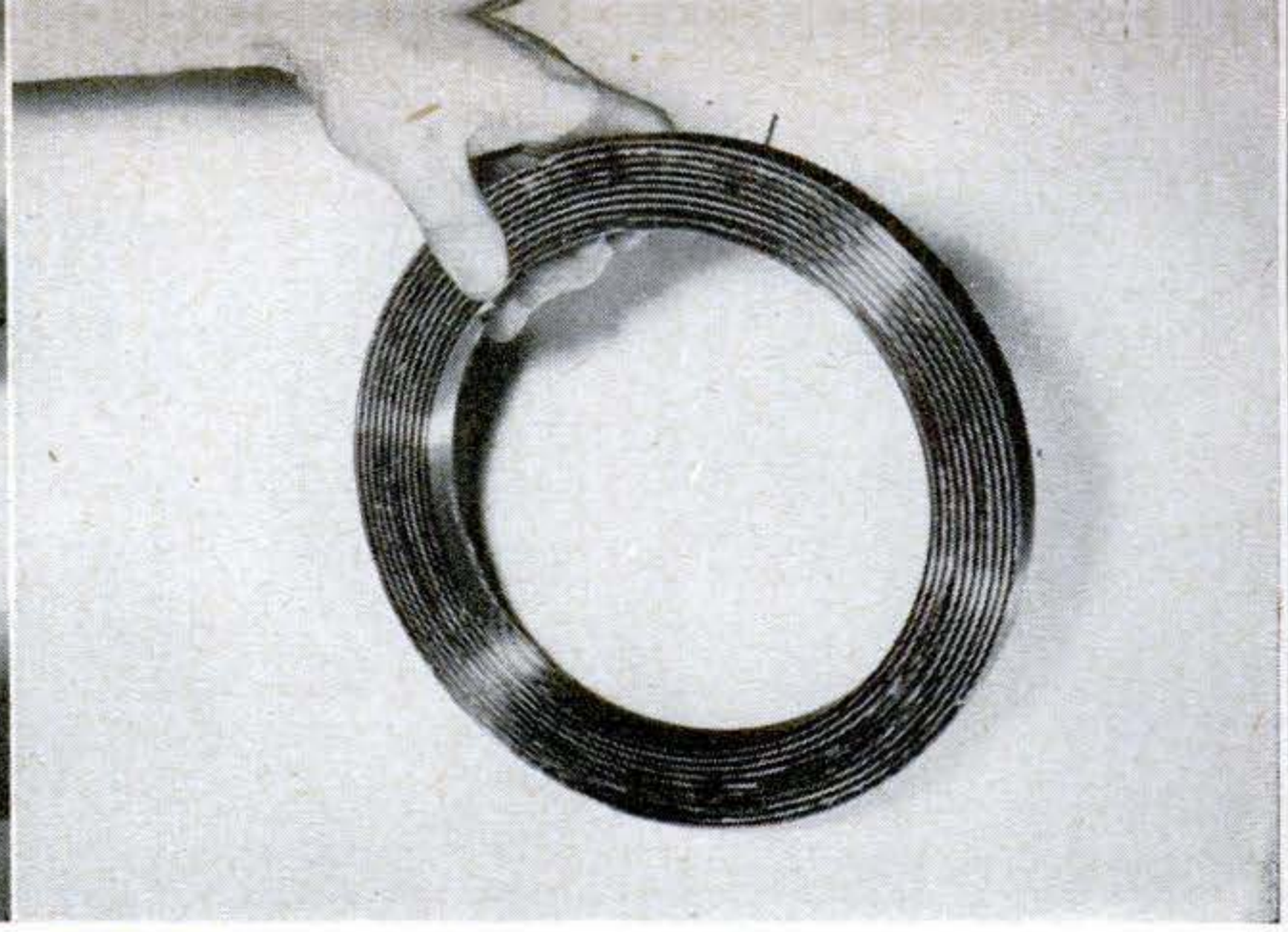


POWDER, sprinkled on a card over a magnet, shows the field pattern. The amount needed in a clutch would just about fill a whisky shot glass. It feels like slightly gritty talcum.



THIS COIL masters the torque of a car engine. It is made up of No. 13 enameled copper wire, and draws about three amperes in average use. Its insulation is heat-resistant.

off the gas, there was a blessed absence of those down-the-scale spasms with which some automatics come to rest.

How come? The way Eaton gets this almost magical performance, without the intervention of hydraulics, is by mating a conventional gearbox with two magnetic-powder clutches. They are *not* the old, current-hungry electric clutches that have long been used in industry. They are, instead, the grandchildren of the magnetic-fluid clutches that were invented by Jacob Rabinow of the U.S. Bureau of Standards (PSM, June '48, p. 83).

Rabinow's clutch used two mechanically separate members with a mixture of powdered iron in oil between them. If current were passed through an electromagnet, the liquid would "freeze" solid, locking the two members together.

It was, and is, an excellent clutch—smooth, very fast, and with a highly controllable slip period. It had what an electronics man would call "high amplification": a little input energy could control a lot of output. The clutches found immediate use in calculators, instruments and intricate military control systems.

But when a magnetic-fluid clutch handled car-sized power, trouble developed. An intense heat was generated in the oil during the brief period of slip—an automotive clutch may have to dissipate 50 horsepower or more for a moment or two—and these jolts of high heat would break down the oil. The fine particles of iron would act like catalysts, and the oil would oxidize into a worthless gunk.

Eaton research men tried every conceivable liquid in a futile search for some vehicle to carry the working iron particles. Then they found that there was no need for a liquid after all—that a handful of powdered iron would work fine by itself. Small amounts of dry additives were found to improve performance—dry lubricants like graphite, steatite or chalk, and other additives to prevent sintering or clumping under high temperature.

The result is an efficient, practically indestructible magnetic substance. It can run red-hot—heated by particle friction during continuous slipping, hot enough to blue the steel clutch parts—without losing its magnetic usefulness.

The clutch this powder works in is amazingly simple. Brushes and slip rings feed juice to the magnetizing coil. Surprisingly little current is needed: about seven amperes will lock the clutch against maximum engine torque, and an ampere or two will lock it against moderate throttle. The sole servicing that Eaton foresees is replacement of the brushes after a few years' use.

What it will do. The simplest application, in a car's power train, is in place of the regular pedal-operated friction clutch. Then, with the addition of a few electric controls, a three-speed gearbox

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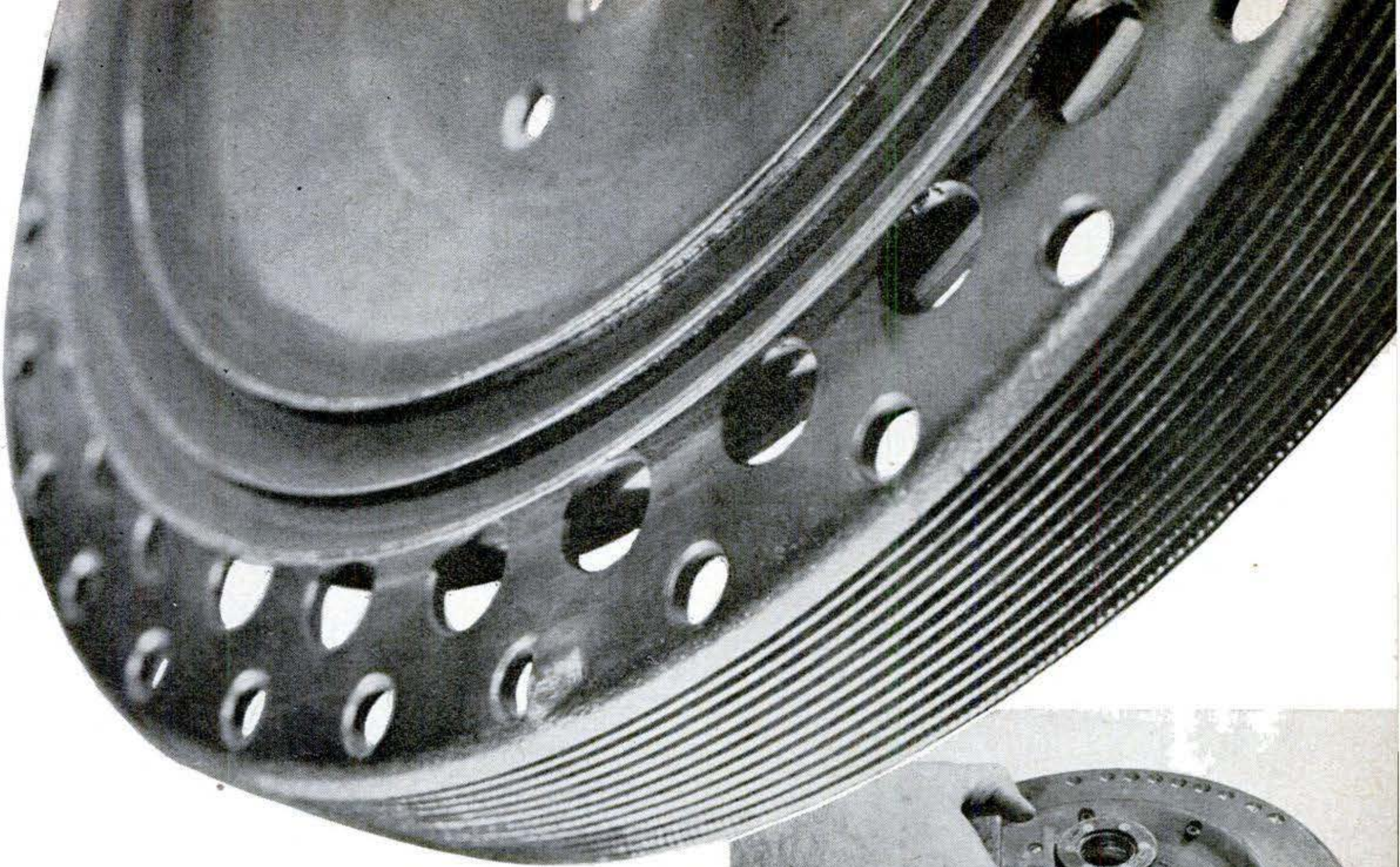

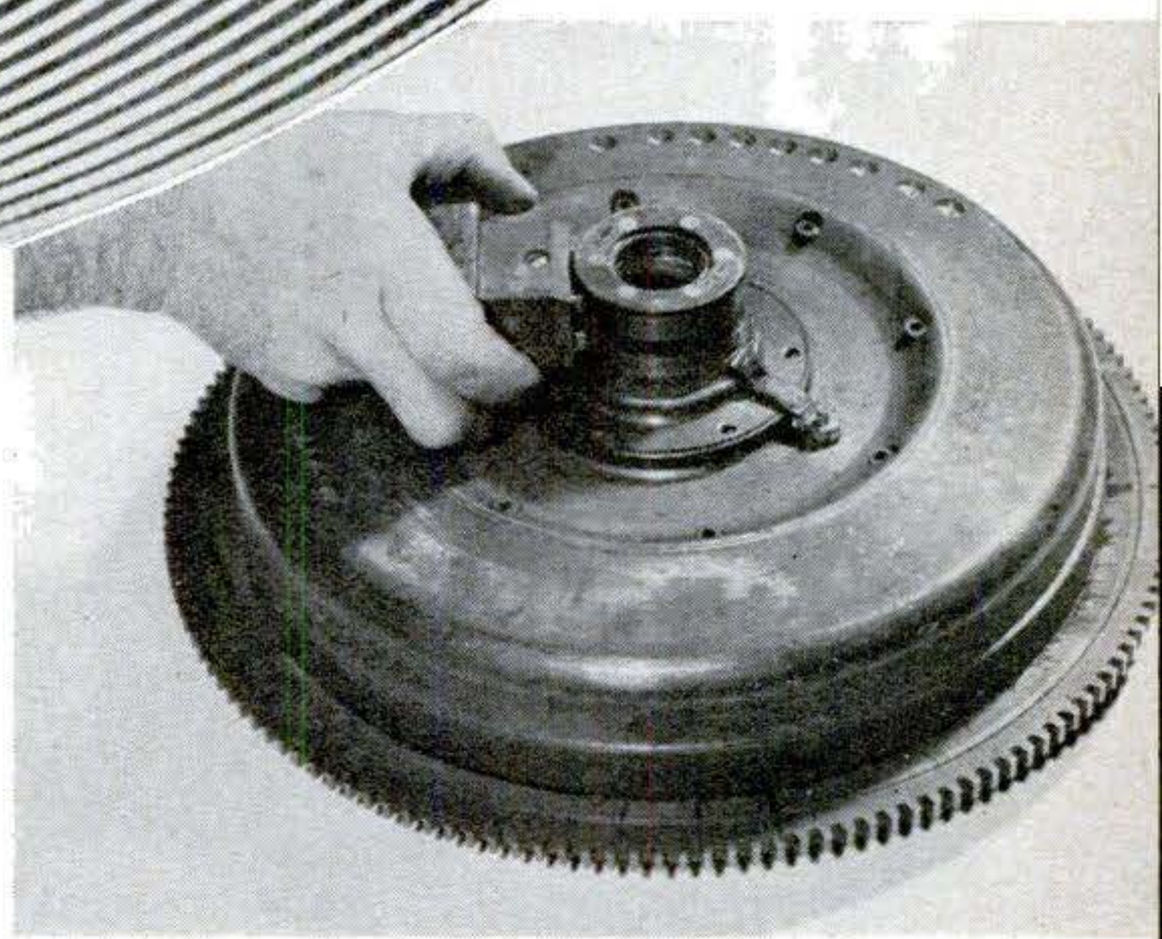

DRUM at the top is the working part of the clutch. Note the three powder-sealing rings at the side. Above, the assembled clutch; the hand is touching holder for electric brushes.

becomes a semiautomatic transmission. Here's how:

Juice to the clutch is fed in part by a variable resistance linked to the accelerator. As you press the gas pedal, the clutch gets an increasing current; it picks up the load and away you go.

But of course a sliding-gear transmission can't readily be shifted unless you break the torque flow for a moment to take the strain off the gears. That's no problem. You just build a switch into the gearshift lever, rigging it so that whenever you supply light pressure on the lever, the clutch instantly disconnects. Touch the lever and the clutch disengages; let go and the clutch holds.

It isn't hard to rig this single clutch into a sweet-handling semiautomatic. A circuit can be arranged so that the car won't free-wheel if you take your foot off the gas. An "economizer" circuit can be devised to feed the clutch just enough juice to lock it for the torque the engine is delivering at any particular moment. It can be rigged to let you start up in high without stalling the engine. (A wire from the generator armature tells the control circuit how fast the engine is running; if the load on starting up in high threatens to stall it, the clutch automatically eases a trifle. So the clutch—which can't wear out—just slips until the car is rolling, and then locks up.)

Full automatics. Magnetic clutches lend themselves to ingenious transmission tricks. The experimental car I drove had a full automatic made by joining two clutches, a three-speed gearbox and a shifting servo. Here's how it worked:

One clutch, energized through the accelerator control, was connected to low gear. It got you rolling. When time for the low-to-second shift occurred, it traded places in the wink of an eye with the second clutch, which was connected to high gear. This took the strain off the gears, permitting the servo to make

[Continued on page 276]

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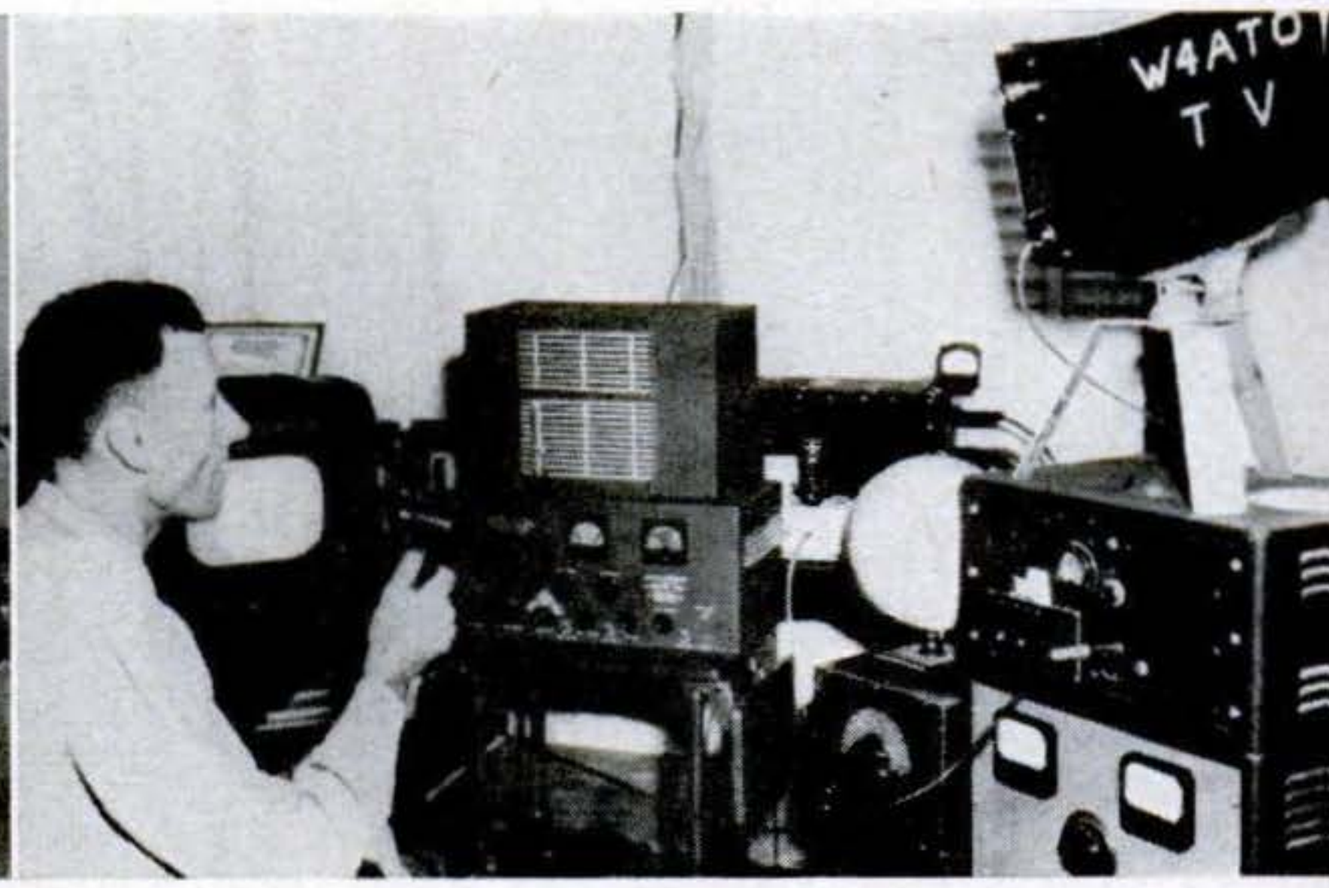
Radio-Controlled Tractor Loads Faster with Less Legwork

When the operator of the string of warehouse trucks above wants to move them forward, backward or around a corner, he does it by radio—without going near the tractor. The remote-control unit is under his hand, hung on his belt. He can control the unit from any distance within his range of vision. When the Barrett Power Ox is fully loaded, he mounts and operates it with the usual controls.



Hams Now See as Well as Talk on Amateur Television

Television couldn't scare off the amateurs for long. Among the many hams now transmitting pictures along with their voices are Seaman Walt Hornung, K6BHF-TV, of San Diego (left above) and John C. Davis, W4ATO-TV, of Albany, Ga. Their telecasts are in the 420- to 450-megacycle amateur frequencies, which can be picked up by ordinary TV sets equipped with slightly altered ultrahigh-frequency converters. Hornung uses surplus radar gear. Davis' camera is a modified three-inch oscilloscope.

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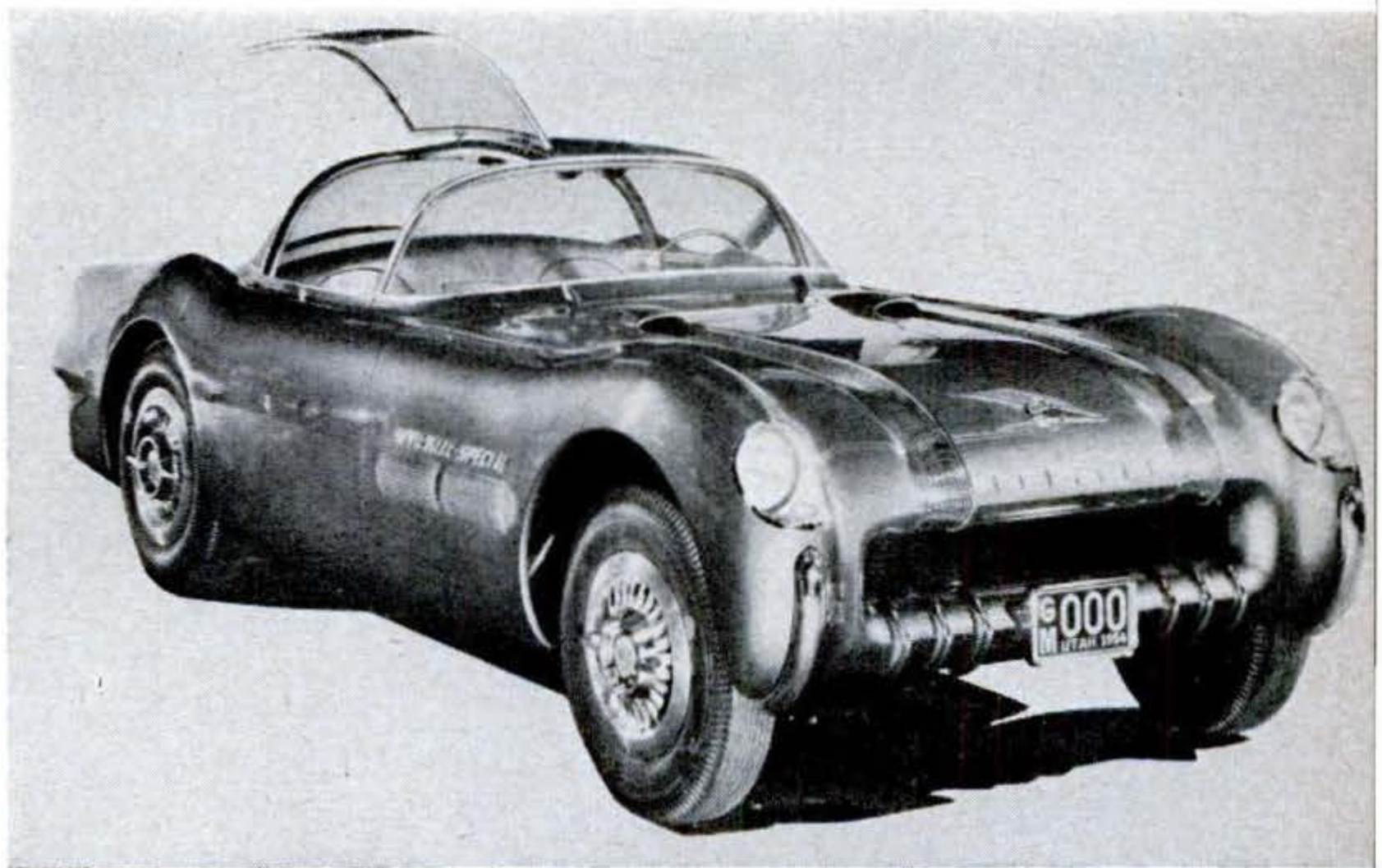
Detroit's Latest Plastic Fantasies

Built to be seen but not sold, they are the banners in front of this year's automotive circuses.



BONNEVILLE SPECIAL
Built for speed, this Pontiac racer has knock-off hub caps and safety belt for driver. It is one of 11 reinforced-plastic cars pictured on this and the two following pages. Stylists' pipe dreams, they were socked into form largely for exhibition at auto shows. You couldn't buy one for a million dollars. They are not for sale.

CADILLAC EL CAMINO
An extra pair of headlights on this two-passenger hardtop automatically turns off when car is in traffic. Featuring Caddy's 230-hp. engine, the 200"-long coupe carries its spare wheel below the trunk.

DODGE GRANADA
Described as first car ever built on conventional chassis with one-piece, all-plastic body, Granada even has bumpers, structural body members and body-attaching brackets of glass fibers. Car is 211" long.

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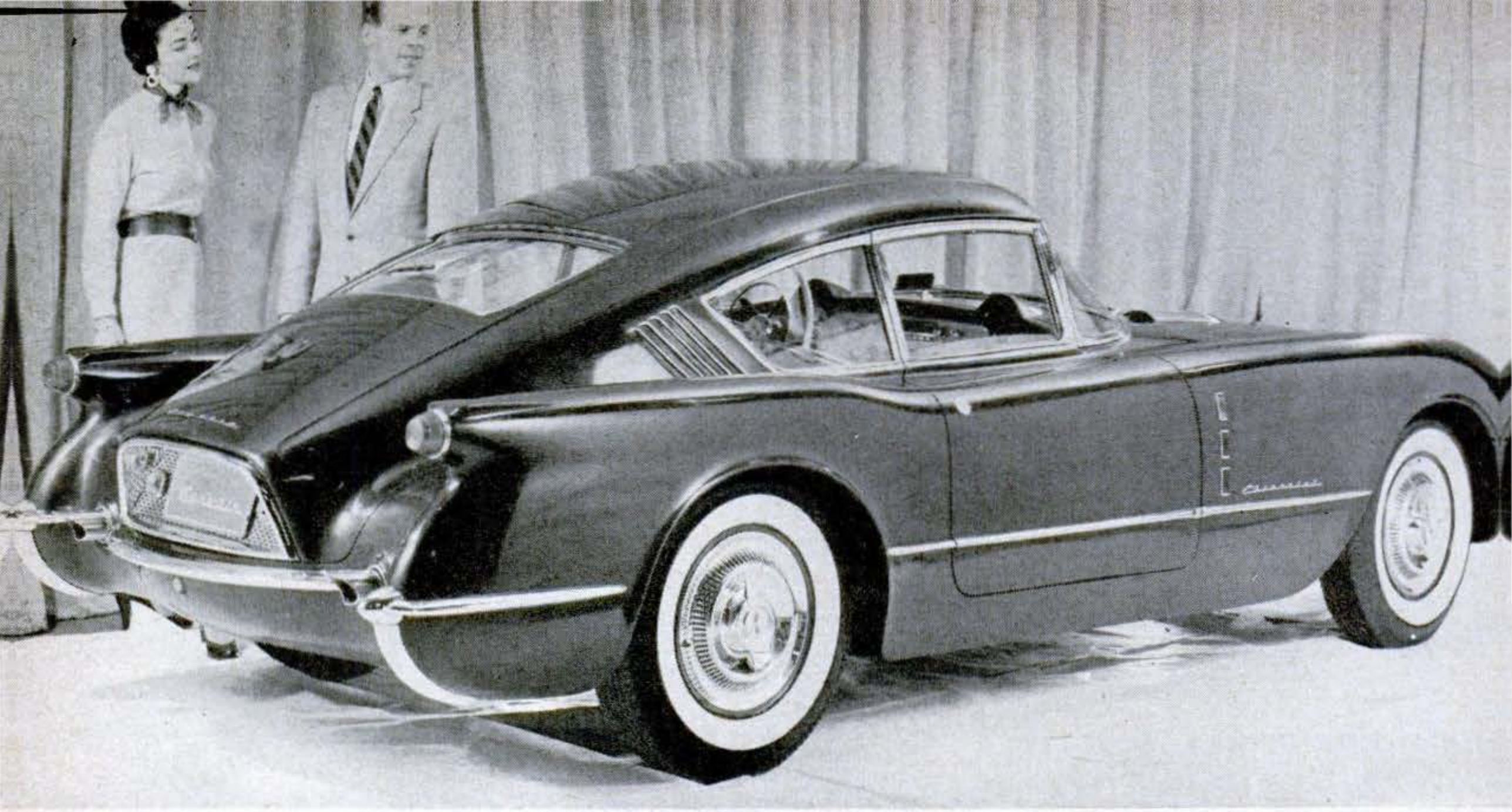
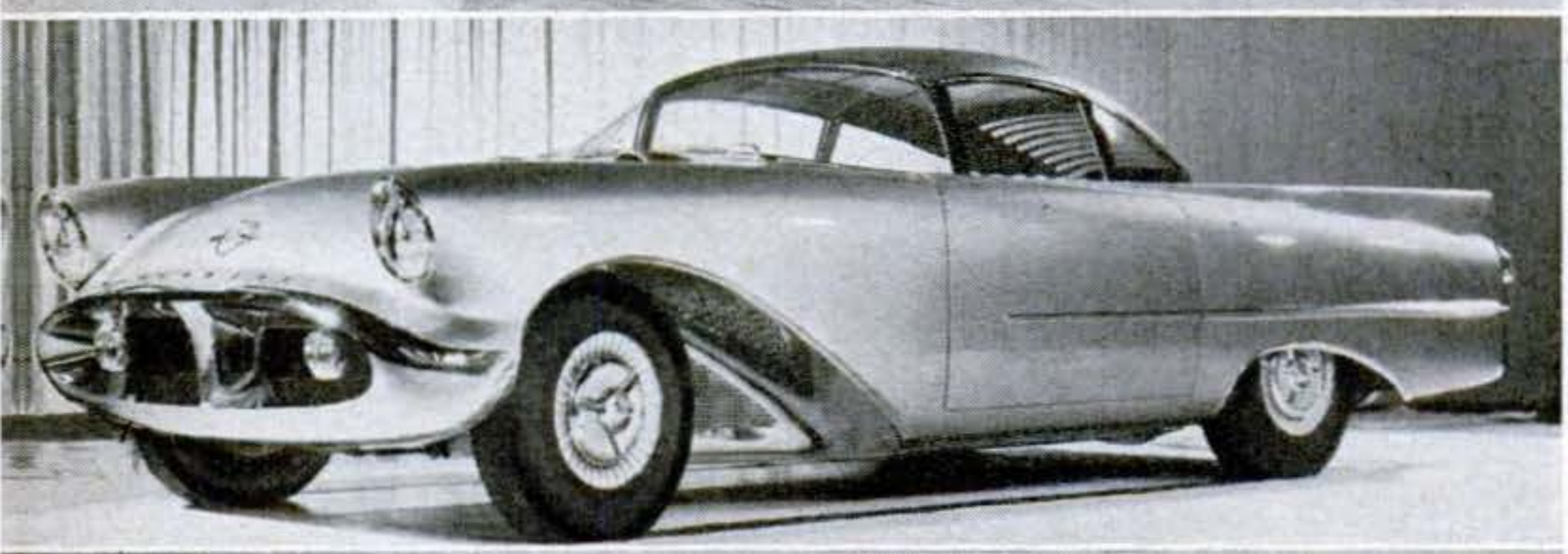


CHEVROLET CORVAIR
A variation on Corvette introduced last year by GM, this Chevvy has a sloping "fast back." It's powered by 150-hp. engine. Car is only 51" high.

CORVETTE NOMAD
Only description that applies here is a sports-car station wagon. It contains two seats, holds six people. Most notable feature is unusual amount of glass area.



OLDS CUTLASS
Most powerful plastic car is this 250-hp. V-8 Olds. It's also one of the fanciest, with radiophone, pivoting seats, louvered rear window. Hood scoops supply fresh air for heating system. Height: 51½".

NEW "CONVERTIBLE"
It is and it isn't. The plastic top unlocks and lifts off this Chevvy Corvette if you want to ride in the open. This probably is the only sports car ever built that retains its pleasing lines with the top on.

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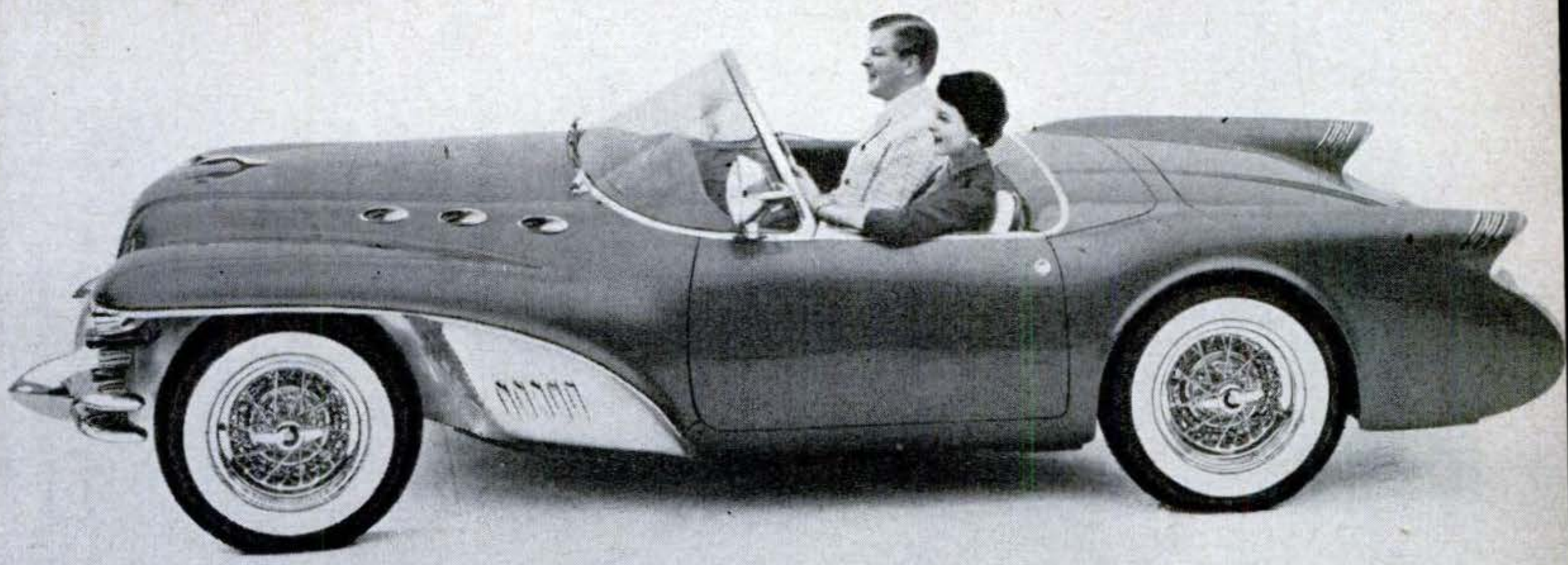
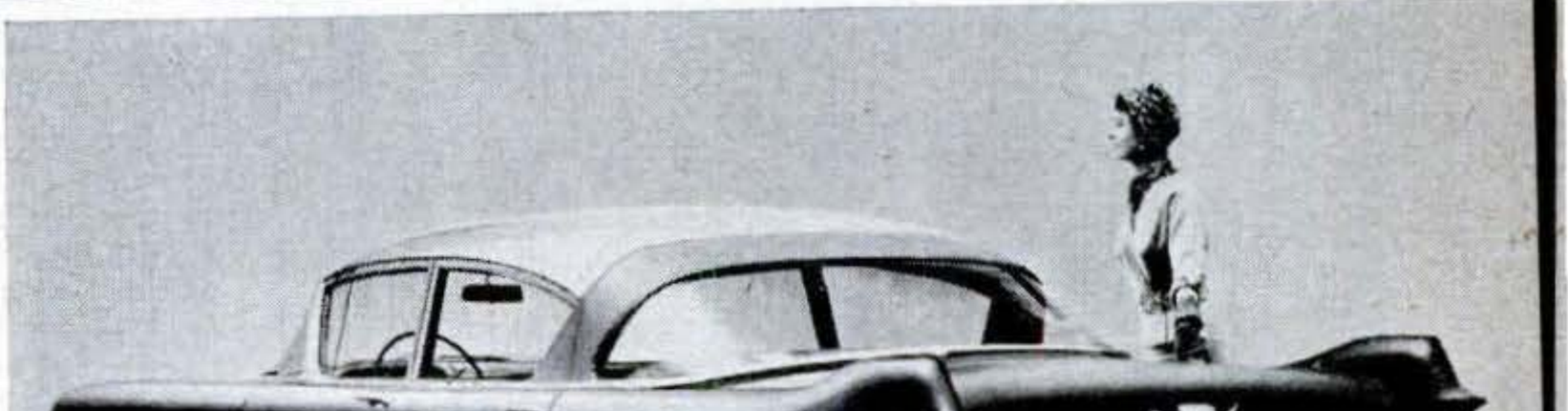
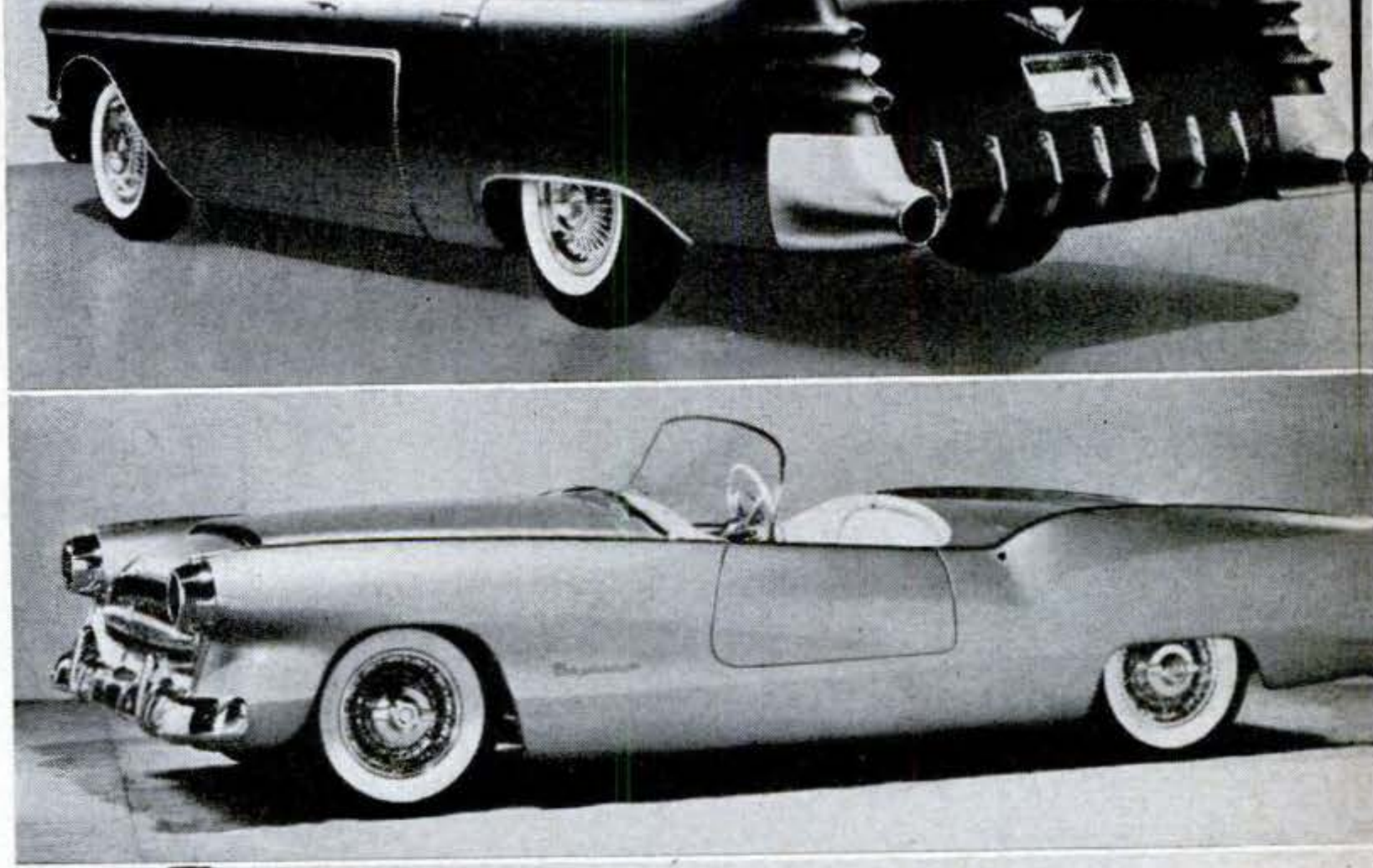


BUICK WILDCAT II
Progeny of last year's Wildcat, this is the smallest Buick ever built — 171" long and 48" high with the top up. Front fenders look like Stutz Bearcat's.

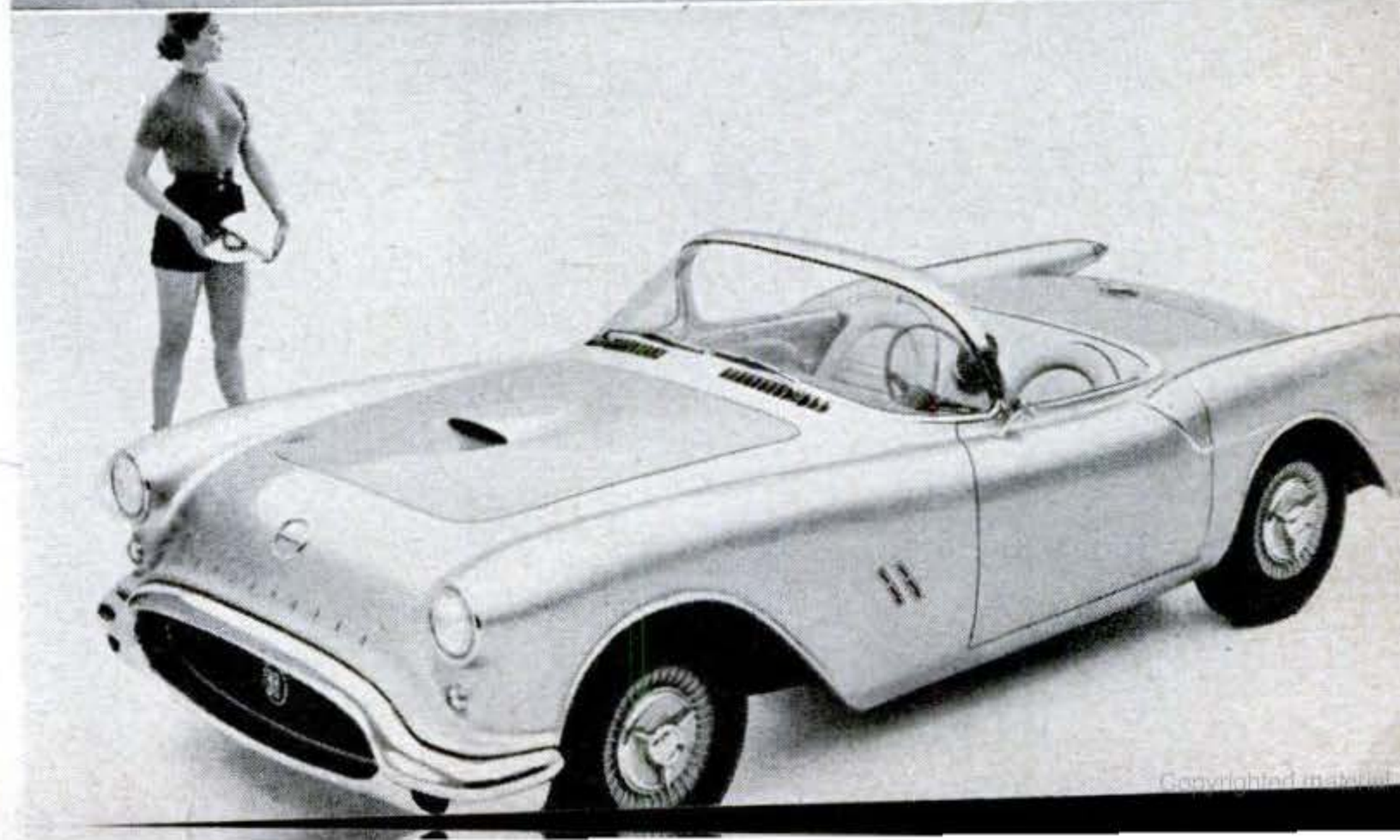
CADILLAC PARK AVE.
The stylists pulled their punches here. Car is conservative. Door handles are shaped like airfoils, wheels are aluminum alloy. Inside trim is of soft gray leather.

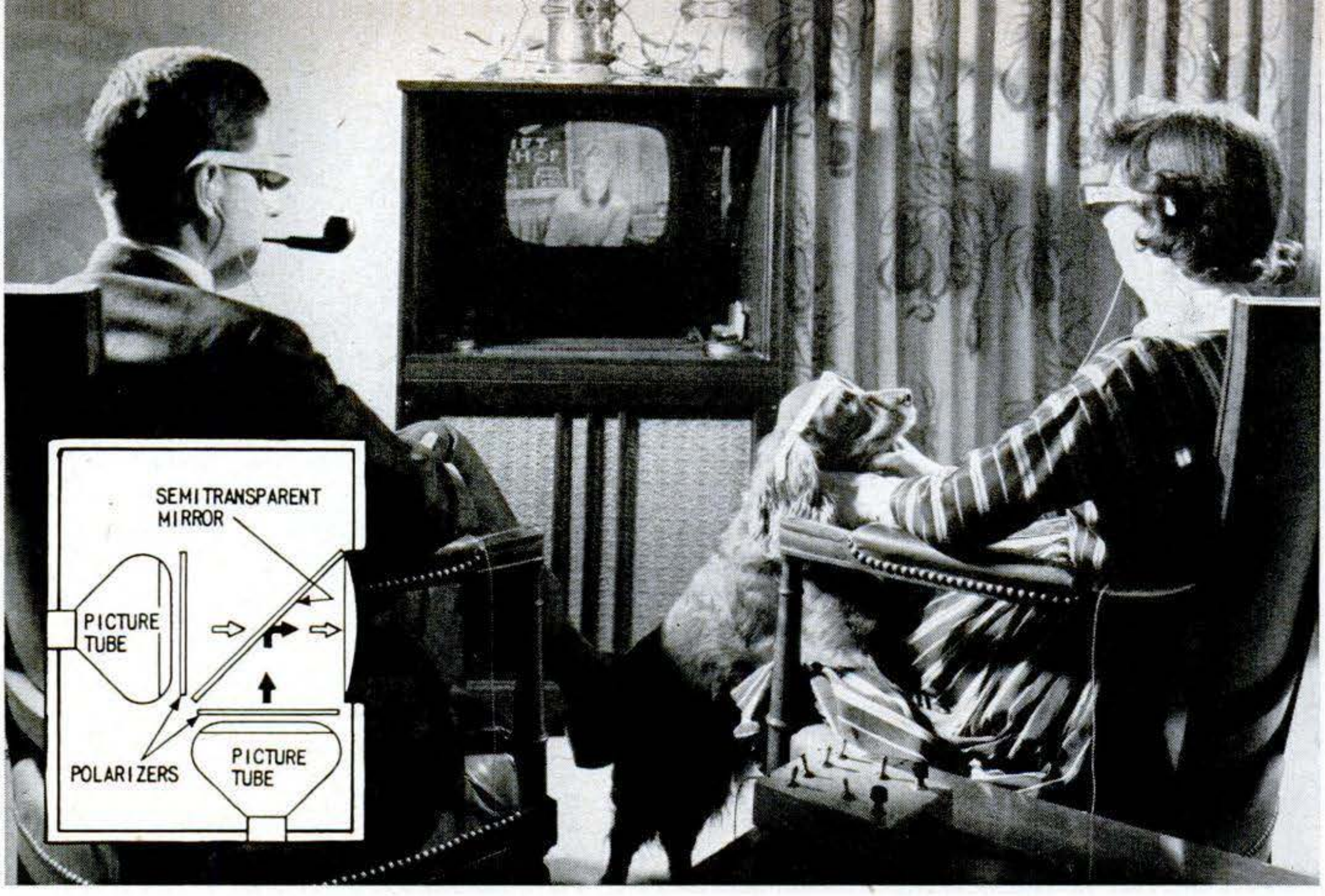


PLYMOUTH BELMONT
Not to be outdone, Plymouth exhibits a plastic car with a height to top of door of only 32¾". Length is 191½". Seats are white leather. Radio controls are on center armrest. Instruments include a tach.



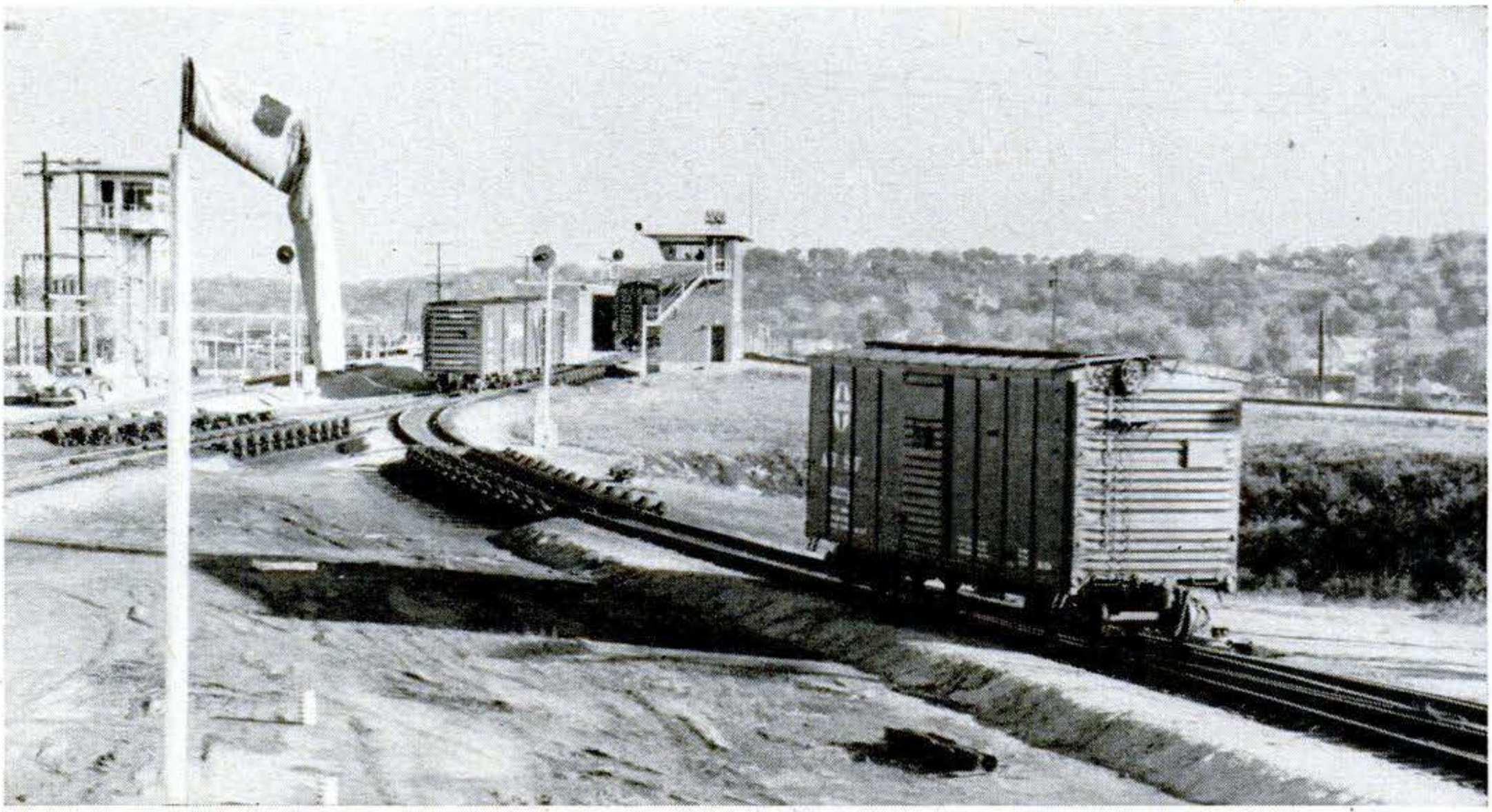
OLDSMOBILE F-88
Steering post on this job is almost horizontal, making steering wheel almost straight up-and-down. Radio speaker is recessed in seat between passengers. Windshield vents supplement cowl ventilators.





Two-Headed TV Set Displays Two Different Shows at Once

Two people can enjoy different TV programs at the same time with a new set. The experimental Du Mont Duoscopic is actually two receivers in one cabinet, with two chassis, two sets of controls and two viewing tubes mounted at right angles (inset). A semitransparent mirror superimposes the two pictures, but each viewer sees only one show by watching through polarizing spectacles. Earphones handle the sound.



Airport Wind Sock Goes to Work in Railroad Switch Yard

THIS wind sock may look out of place in a railroad yard, but it's there for a purpose. Towermen (center background) study its angle when they roll freight cars down the "hump" into classification tracks, near Kansas City, Mo., for proper coupling. Wind affects the speed of free-rolling cars, and the sock tells the Santa Fe Railway men how much grab is needed from the track retarders to slow them down. The retarders —compressed-air external brakes—can be seen along the tracks at left center.

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New Ferrari Hits 155

THIS Ferrari America 375 has a new hydraulic-brake system with two cylinders per wheel. Its V-12, 300-hp. motor with three carburetors, dual ignition and twin fuel pumps pushes it in fourth to 155 m.p.h.

Canopy Converts a Scooter

THIS canopy to protect scooter jockeys from bad weather was exhibited at a car and motorcycle show in Milan, Italy. When not in use, it folds up small enough to fit into the bag on the rider's lap.

Smoking Keeps Driver Awake

THE man at right is holding a German invention designed to keep drivers from falling asleep at the wheel. A cigarette holder wired to the dashboard, it sounds an alarm as soon as it is dropped from the mouth.

Argentine Car Is Plastic

ARGENTINA's first stock cars—a convertible (below) and a sedan—will be sold only in South America. Both have 60-horsepower four-cylinder engines. A top speed of more than 90 m.p.h. is claimed for the plastic sports car.

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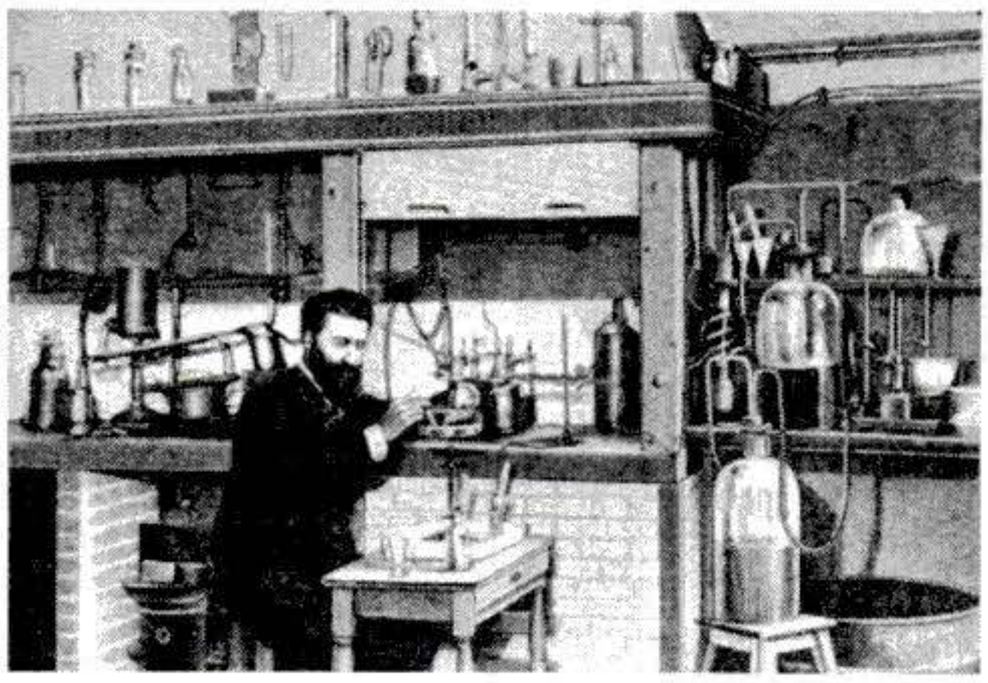
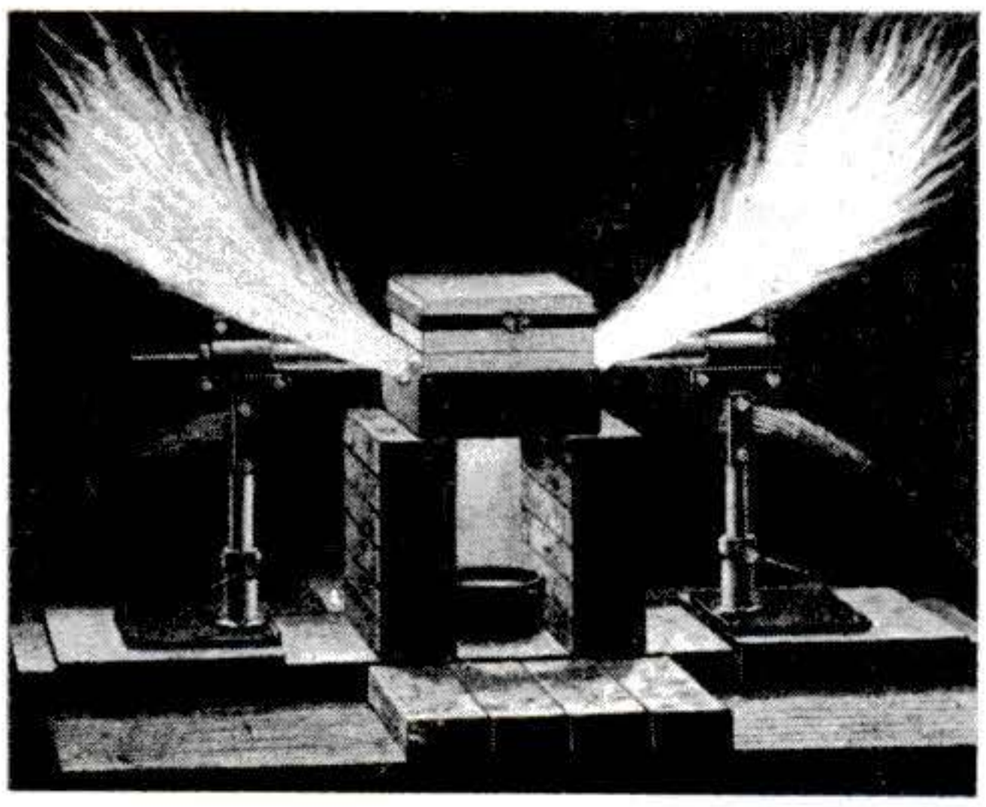
Within the last decade and a half, a new industrial revolution has been brought about by **The Hardest**

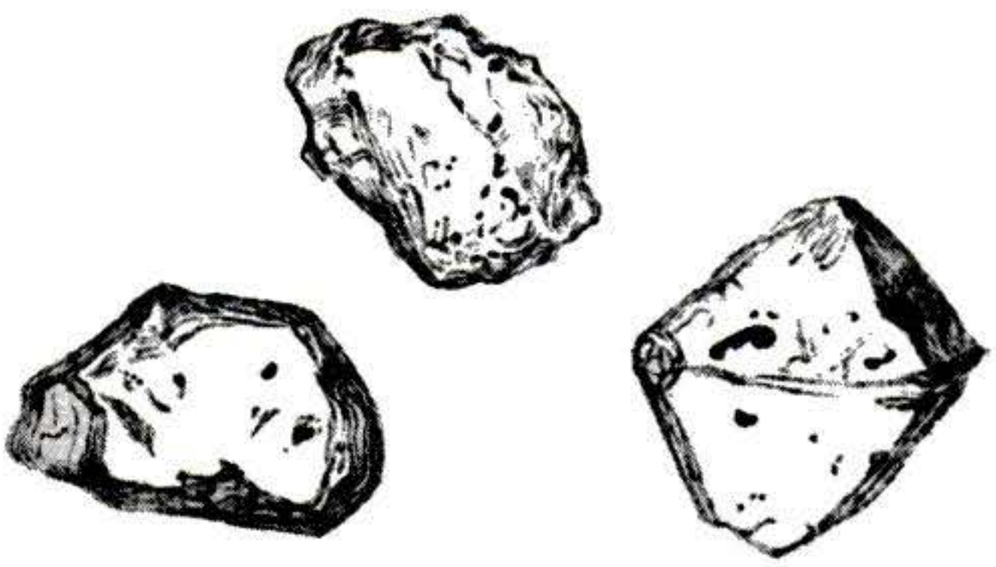
Seeking Diamonds, Chemist Obtained Tungsten Carbide



PIONEER in producing tungsten carbide was French chemist and synthetic-diamond maker Henri Moissan. Picture of him in lab is from *La Nature* magazine of 1890.



WITH ELECTRIC FURNACES like this one, in historic experiments, he made microscopic diamonds; and tungsten carbide, too.



HIS TINY DIAMONDS, shown 50 times actual size, made the big news—but time was to prove tungsten carbide more valuable.

By Richard Match

ONE single development of recent years has multiplied man's return for his labor more than any other innovation since James Watt invented power-driven machinery 200 years ago. Metallurgists have simply put "cemented carbide" cutting tips and wear surfaces on the machine tools and dies that cut, drill, stamp and shape metal parts in our factories. Hardest of all metals made by man, the carbides slice through iron and steel like a knife through cheese.

The results have been spectacular. Today, three auto workers with carbide-tipped tools can machine 48 engine blocks an hour; in 1941 the same job would have required 48 men. Now one man can turn out nearly 50 crankshafts an hour compared with 11 under the old methods. In U. S. arsenals a man shapes twice as many gun barrels per shift as he could before Pearl Harbor, produces four times as much armor plate. In other U. S. factories, carbide tools are turning out at an unprecedented rate a torrent of toasters, airliners, stoves, tractors, golf clubs, lipstick cases—anything made of metal.

Car Cost Would Climb Without Carbide

Automobile executives estimate that without carbide tools the 1954 car would cost about double what it does now. Why? Because carbide tools outlast tools made of the toughest high-speed steel by as much as 100 to one. They cut metal five or six times faster, stay sharp 10 to 20 times longer, and save 65 percent of the man-hours once expended in metal cutting. Carbides are the metals primarily responsible for high-speed mass production as we know it in the middle of the twentieth century. More-

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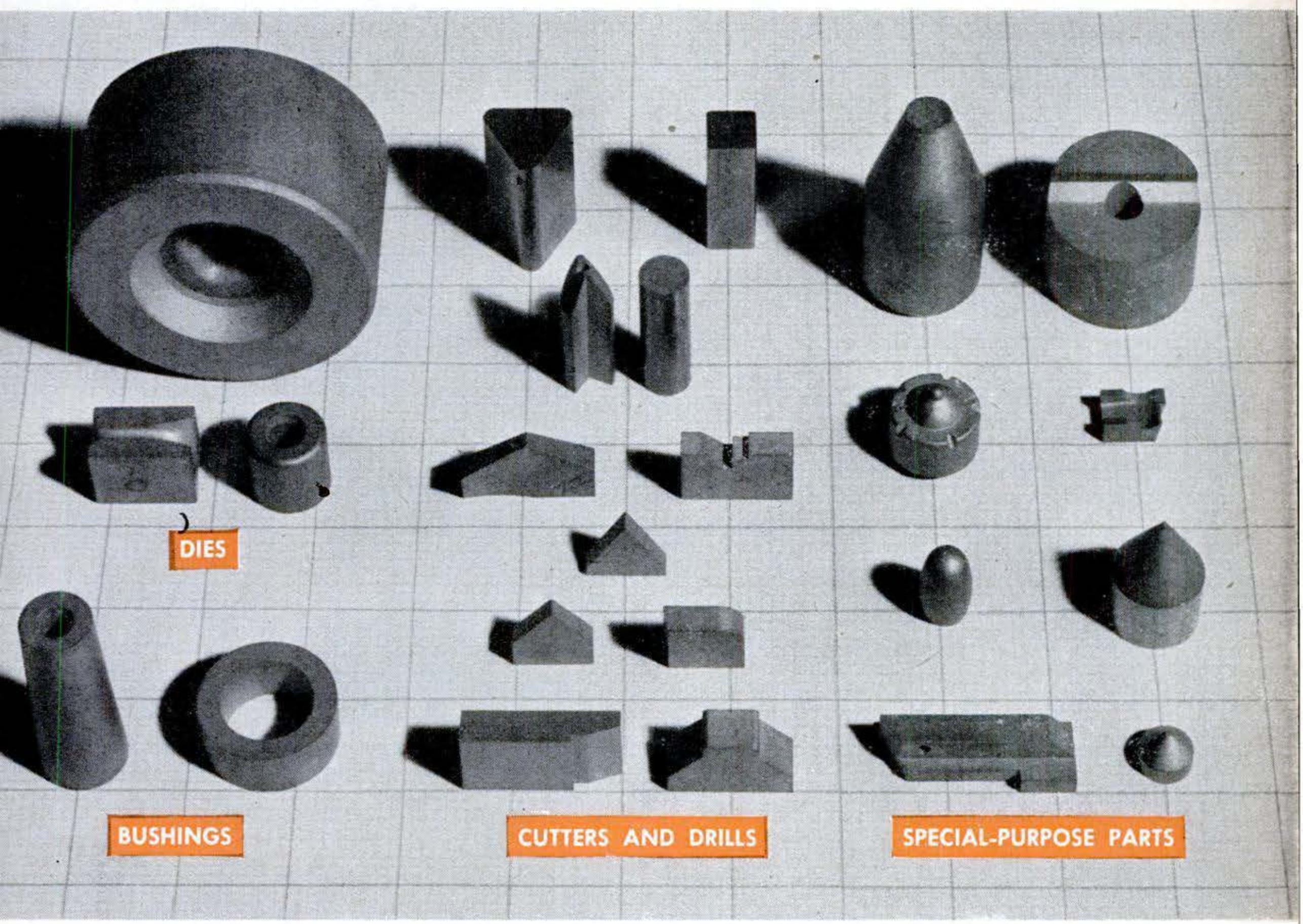
Metals Made by Man



These 24 tungsten-carbide pieces for tools and machines illustrate variety of shapes and uses.

over, we are just on the threshold of their use. Further advances promise to boost American productivity beyond anything known today.

Carbide tools have already made the jet age possible. No other known metal is hard enough to cut the so-called superalloys—from which high-temperature jet parts are made—at production-line speeds. General Electric, for example, is the nation's largest manufacturer of jet engines. "If we were to produce jet engines at our current rates, and do this without the aid of carbide cutting tools," a GE executive told me, "we would need to expand our present production facilities five times. That means five times the number of factories and machines, five times the labor force. And the nation would be footing the bill in extra taxes."

Carbides slice through iron and steel without hesitation, but they contain neither iron nor steel themselves. They are instead chemical unions of carbon with one or more metals like tungsten. By the only half-understood magic of chemistry, the wedding of carbon with almost

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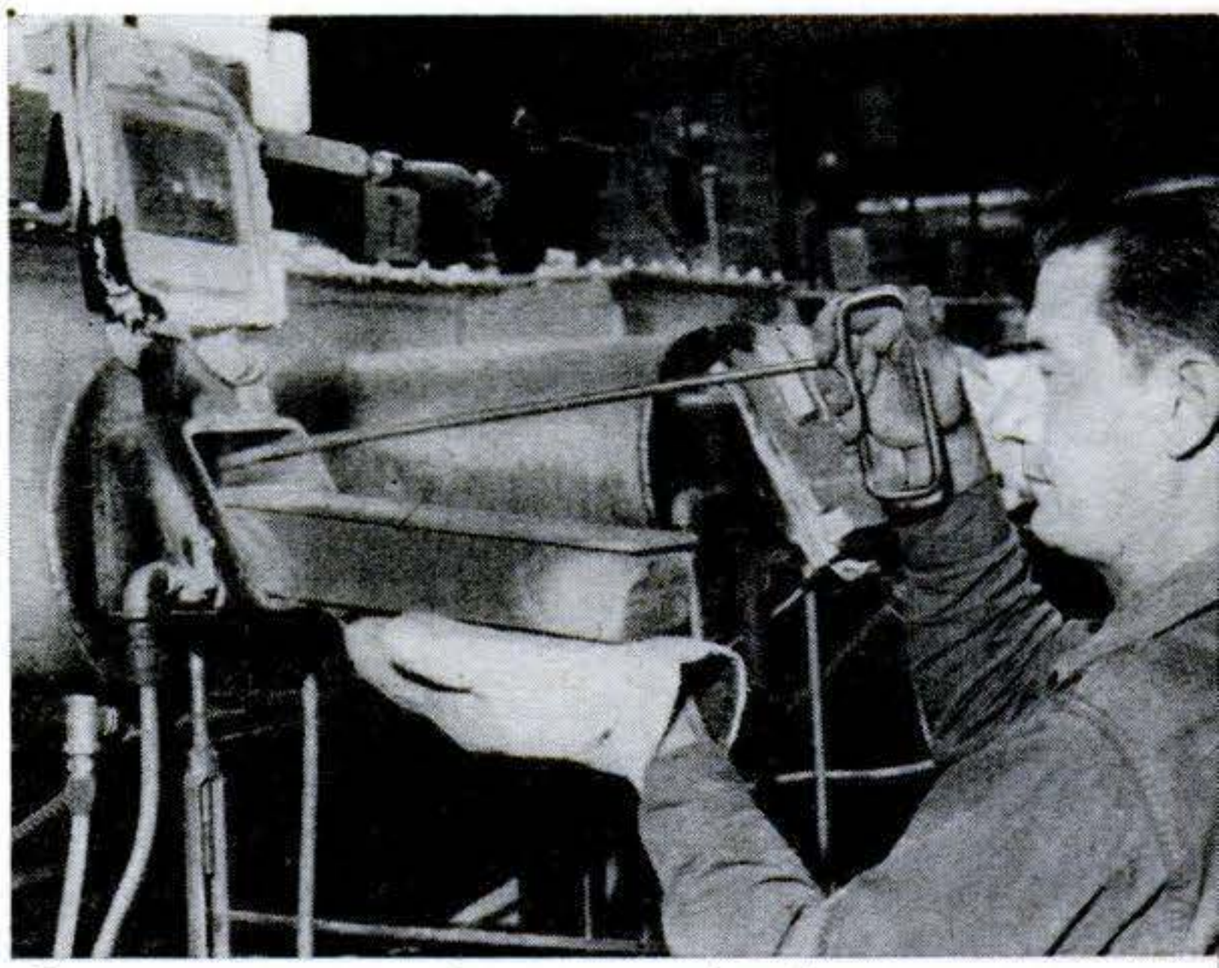
How They Make Carbide Tool Tips

1 MIXER like household kind holds blended ingredients, lampblack and pulverized metals of face-powder fineness, at Harrison, N.J., plant of Adamas Carbide Corporation.



4 TRANSFORMED into superhard tungsten carbide, past cutting or shaping except with such implements as diamond tools, sintered tablets come out of furnace.

any metal begets a "carbide" immensely harder than either parent alone. The tungsten-and-carbon alloy which started the whole thing has had a curious history.

In 1896 a French chemist named Henri Moissan happened onto a report about Devil's Canyon, Arizona. Some prehistoric meteor had plowed into the desert there, gouged a crater a mile across, and left behind meteorite fragments peppered with tiny diamonds. Scientists suggested that the heat and pressure of the molten meteoritic iron had made these diamonds from embedded charcoal specks. It was logical, Moissan reasoned. After all, diamond and charcoal are related forms of the same common Jekyll-and-Hyde element, carbon.

Moissan asked himself a question. If he could simulate meteoritic conditions in his laboratory, could he manufacture diamonds?

Man-Made Diamonds Are Too Small

In an electric furnace of his own design, he built the hottest fire man had made up to that time, inserted chunks of iron and lumps of sugar burnt to charcoal. While sparks hissed and leaped around the laboratory, he withdrew the fiery mass, plunged it into a cooling bath, and waited expectantly, like some alchemist of old. It worked!

But there was a catch. Moissan's biggest diamond was smaller than a pinhead and worthless commercially.

Disappointed, Moissan tried heating carbon with other elements, among them tungsten, which had the highest melting point of any pure metal—6,100 degrees Fahrenheit. This time the experiment produced dull pebble-sized particles—not diamonds, but a new chemical compound nearly as hard: tungsten carbide. Moissan threw them aside, baffled again.

The Frenchman's numerous other chemical discoveries earned him a Nobel Prize 10 years later, and he died soon after, never suspecting the importance of his strange metallic pebbles.

Then, during World War I, Krupp scientists tried to synthesize a substitute for badly needed industrial diamonds by Moissan's method. They failed. But they noted the Frenchman's observations about the "useless" by-product—tungsten carbide. They discovered that they could crush these hard particles to powder, then cement them together chemically with softer cobalt to form a tremendously hard alloy. But there were difficulties in shaping it that brought the price to a prohibitive $453 a pound.

General Electric acquired American rights in 1928, and during the lean depression years American metallurgists

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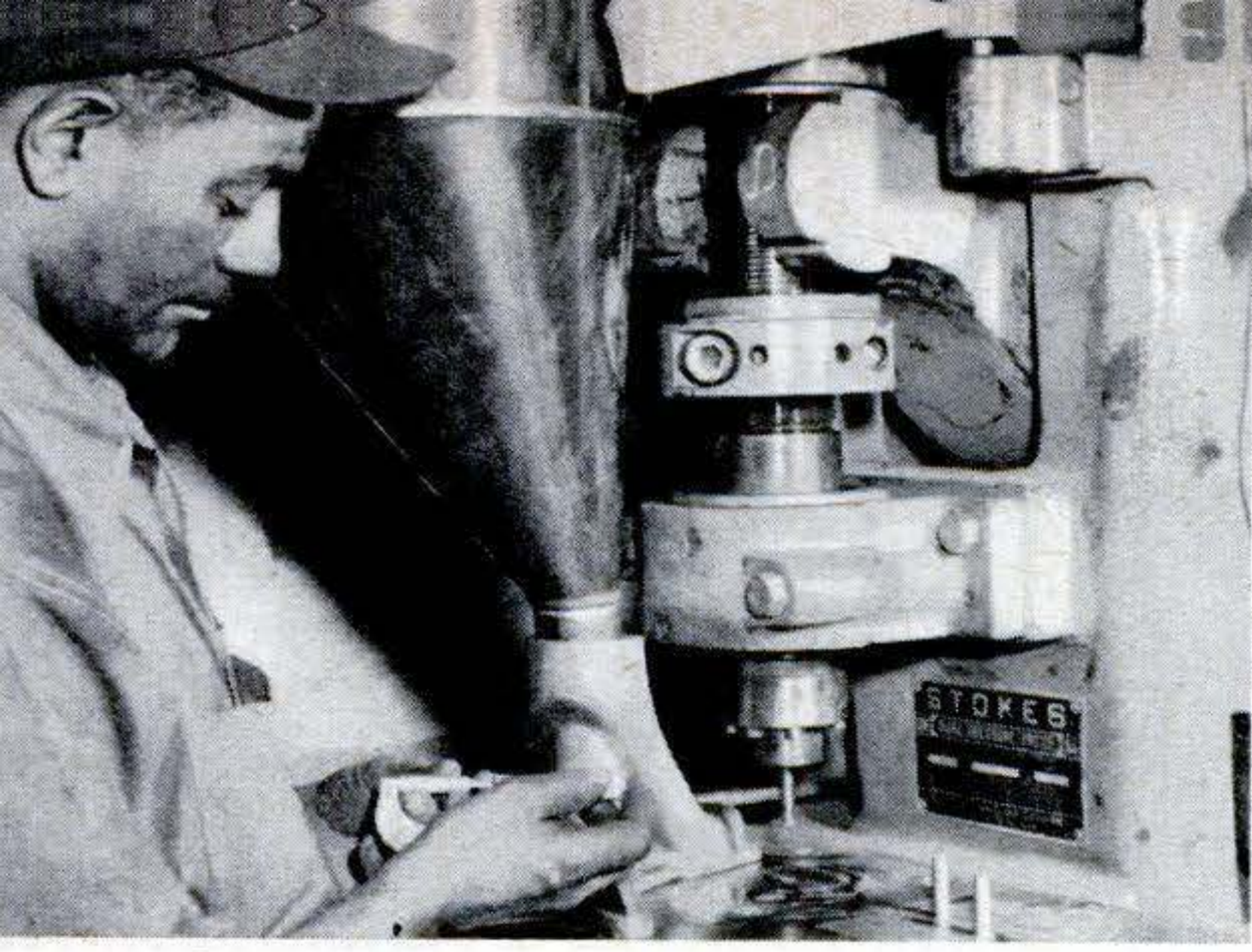
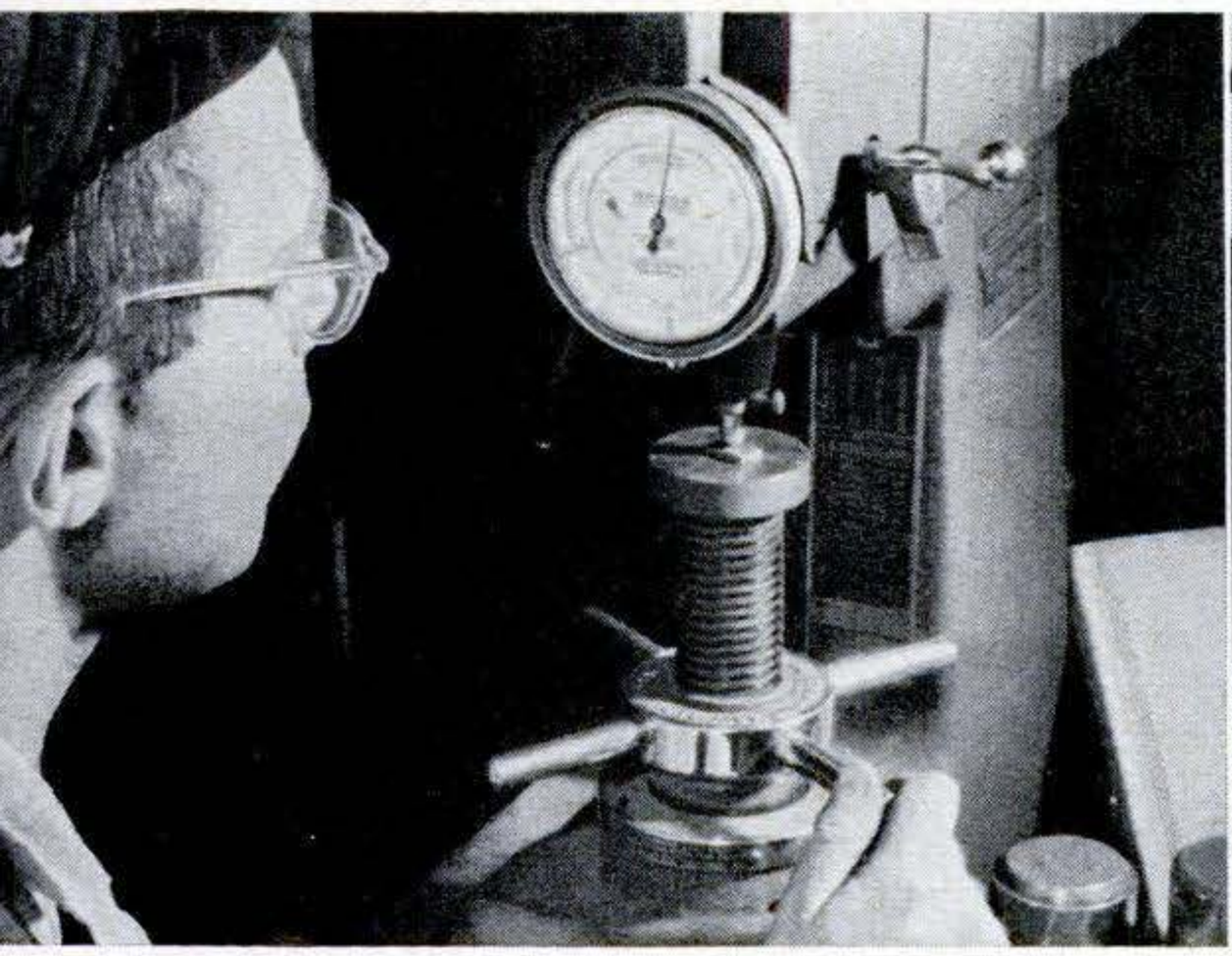


2 PRESS squeezes mixture of metallic powder into tablets—small blocks that are hard enough to be handled, but soft enough to be easy to bring to desired shape by grinding.

3 TABLETS are placed in receptacle, above, for baking in furnace whose heat will fuse bonding material of the mixture—a process known to metallurgists as sintering.



5 HARDNESS TESTER of Rockwell type confirms that product meets specifications. In hardness, tungsten carbide outranks every natural substance but diamonds.

6 FINAL INSPECTION completes making of tungsten-carbide cutting tips, dies and wear parts. Inserted in cutting tools, carbide tips will slice easily through steel.

ironed out many of the bugs in the German product. They cut production costs, learned how to fasten tiny inexpensive carbide cutting tips onto ordinary steel holders, finally hurdled the major weakness of the German supermetal: the Krupps' pure tungsten-carbide tools could slit iron at dizzy speeds, but friction against steel quickly ruined them; by adding pinches of "slippery" tantalum and titanium to the tungsten-carbide base, the Americans lessened the friction.

It Starts as a Powder

Today the price of tungsten carbide is one-twentieth the original price, and cemented carbides can be made in almost any size or shape. Pulverized metals the consistency of face powder are fed into the beginning of the production line; the hardest metals made by man are shipped from the other end.

In the Adamas Carbide Corporation's Harrison, N. J., plant, I saw metallurgists blend lampblack with tungsten and cobalt powders so fine that there are trillions of grains in each pound. Power presses—giant cookie stampers with a force of 30 tons per square inch—rammed the powder into shapes soft and crumbly as aspirin tablets. In the final step the metal cookies were baked in big ovens until the cobalt "cement" melted and hardened around the particles of tungsten carbide. When they emerge from

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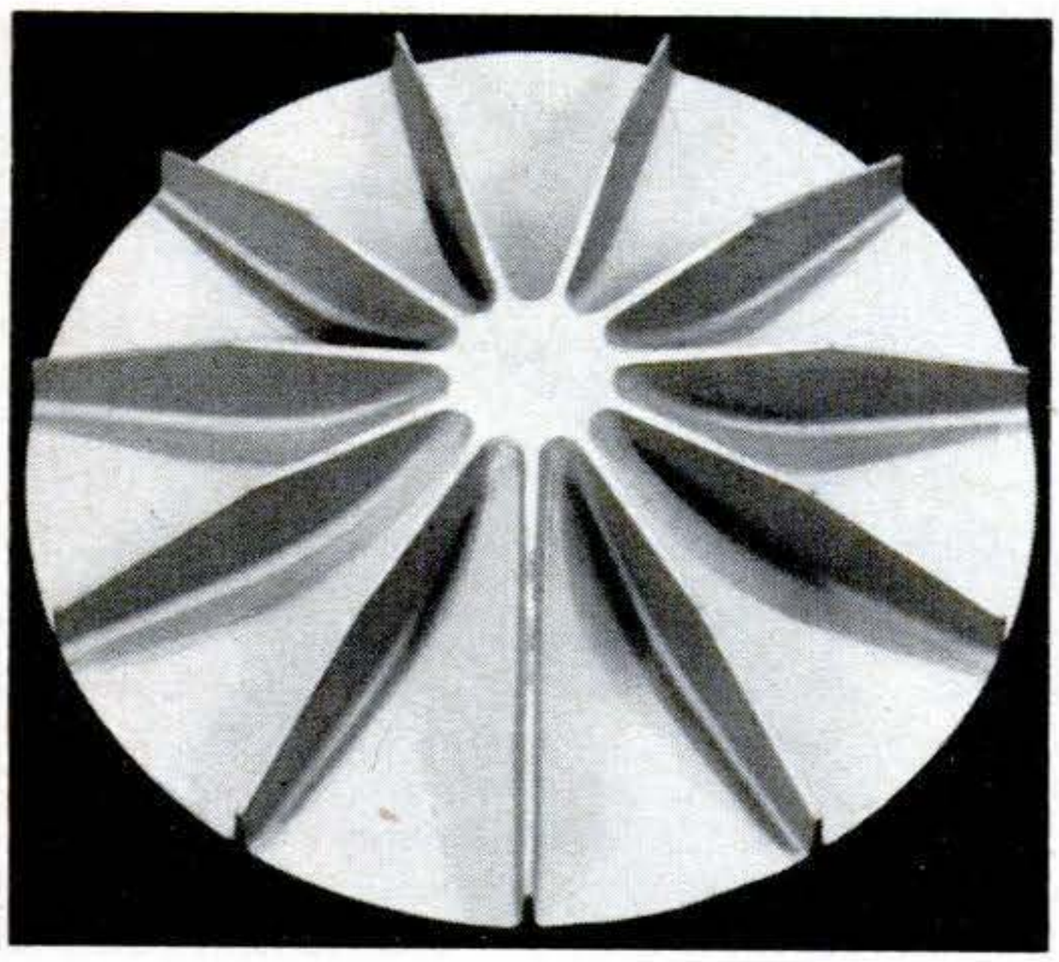
INTO BREECHBLOCK of 14-inch Army gun, upended in concrete, go ingredients for titanium carbide. Explosion of powder charge applies pressure of many tons to square inch.



TURBINE IMPELLER for jet engine uses titanium carbide, made as above by Kennametal Inc. of Latrobe, Pa. Material has been baked after "explosive pressing" in breechblock of gun.

the ovens the once-crumbly shapes are so hard that even when reheated to a cherry-red 1,200 degrees by the torrid friction of high-speed metal cutting, they remain on the job, hard and keen, harder than the hardest steel is at room temperature.

The product goes into household articles, and other familiar ones, as well as industrial tools. Better lawn-mower sharpeners, better paint-scrapers and glass-cutters, faster-drilling dental burrs —which generate less heat and consequently less pain—are a few of the everyday conveniences made available by the invention. I have one of the new knife-sharpeners in my kitchen—two tiny chips of tungsten-carbide metal set in a plastic holder. Swish your carving knife or scissors blade three times, lightly, between the opposed carbide "jewels" and it comes out razor-sharp.

Plane Parts Sheathed in Carbide

Today a farmer can have his plowshare "hard-faced" with tungsten carbide in a local welding shop. Bulldozer blades now get the same treatment, as do cement mixers, threshing-machine teeth and airplane tail skids. One new process deposits a carbide film less than one thousandth inch thick on other metals. If an airplane manufacturer needs a light but rub-resistant motor part, he can encase weight-saving aluminum or magnesium in this wear-resistant tungsten-carbide skin.

"Down time"—the unscheduled halt to replace worn or broken parts—is the enemy of high-speed production, the idler of expensive machines and skilled men. Until recently a sewing-machine operator stitching mattresses used up two needles per mattress. For every 15 minutes of actual sewing, he spent 10 unproductive minutes changing dulled steel needles. Now, a single carbide needle stitches 600 mattresses for him between replacement halts. And in the time once wasted making more than a thousand needle changes, he can sew 400 additional mattresses.

The Mesabi Calls In Its Reserves

Nearly two-thirds of the iron ore used in American blast furnaces in this century has come from Minnesota's famed Mesabi Range. But the Mesabi's high-grade ores are running out, and tapping the vast bodies of flint-hard low-grade rock nearby has not been feasible without an economic way to drill blast holes for dynamite charges. Diamond drills cost too much. Steel drills dull too quickly, make the process prohibitively expensive.

[Continued on page 280]

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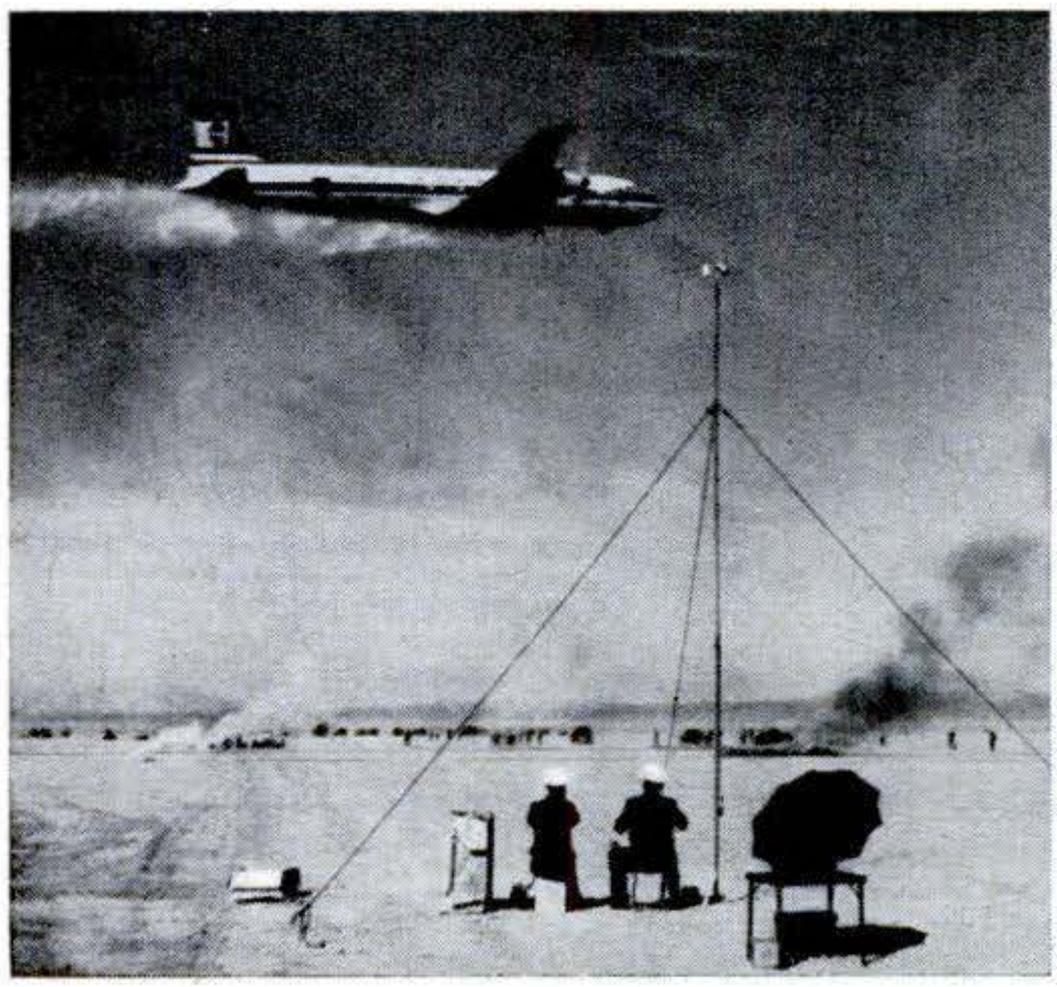
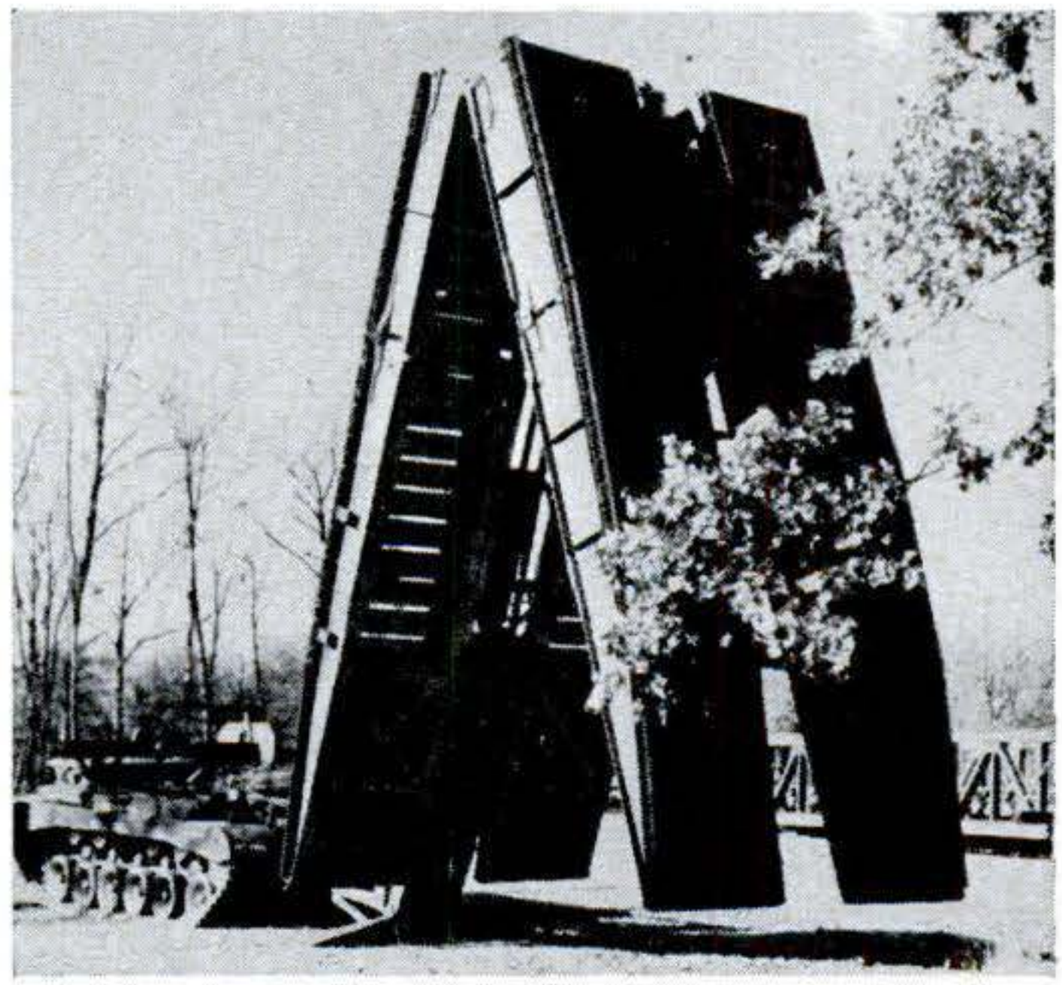
"Automat" That Rides the Rails Is a New Kind of Diner

THIS "Automat"-on-wheels supplements the dining-car service on a New York-to-Washington train. Six vending machines, stocked with fruit juice, sandwiches, desserts, coffee and milk, offer a lunch for 75 cents. There are seats for 12 diners and a bar where an attendant serves mixed drinks and makes change for the machines. The car is a Pennsylvania Railroad experiment for licking the high cost of travel meals.



Brush Fire Is Hosed from Air

THE transport above is dumping 1,600 gallons of water on burning brush in a California test of aerial fire engines. Experts plan to use such planes—toting 10,000 gallons of water—to wet down forest fires until ground parties can beat their way in.



Bridge Folds Like Scissors

ARMY engineers don't have to scramble around under enemy fire to set up this aluminum bridge at narrow-gap crossings. Flipped open hydraulically, it is launched by the modified tank that hauls it. It can carry loads up to 60 tons.

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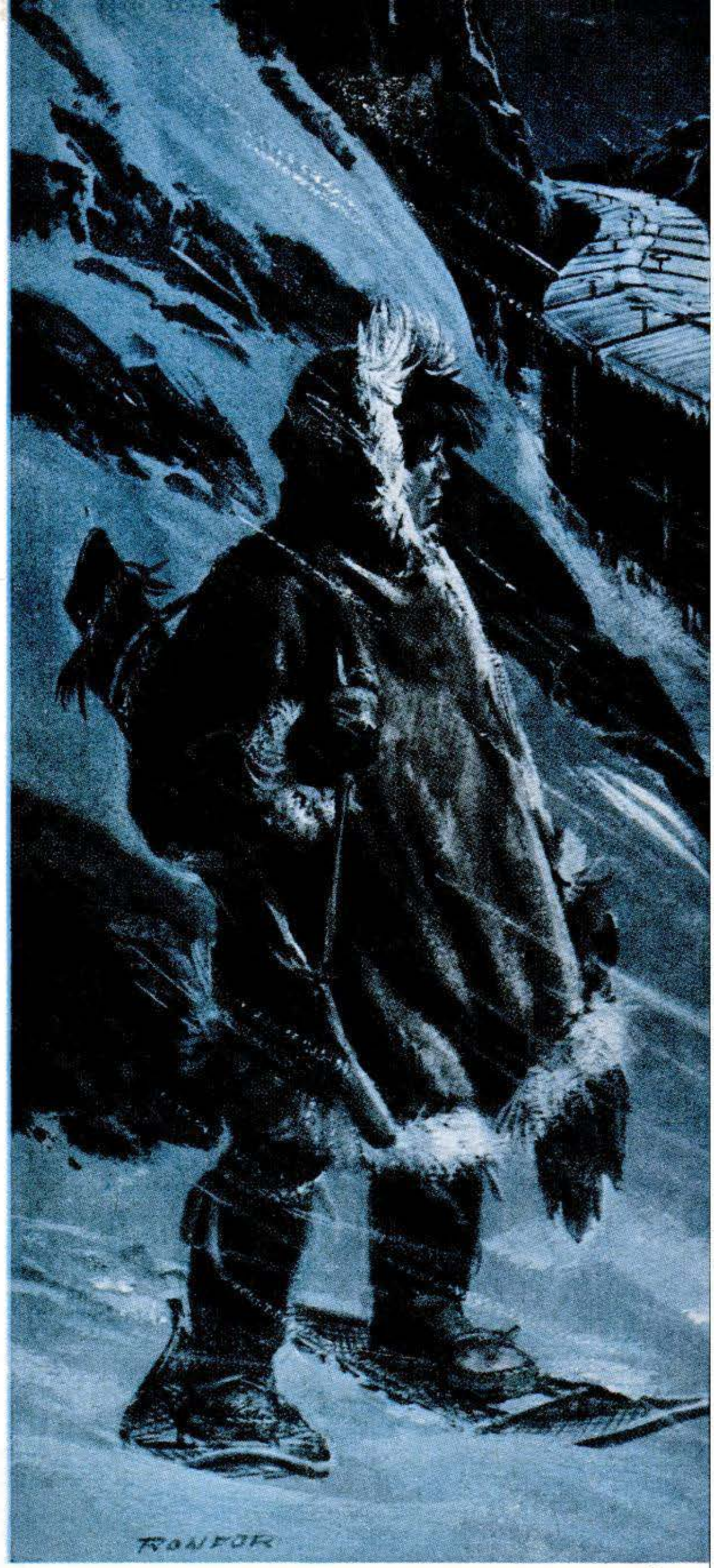
Baby diesels will challenge Yukon's brutal blizzards on

America's Toughest Railroad

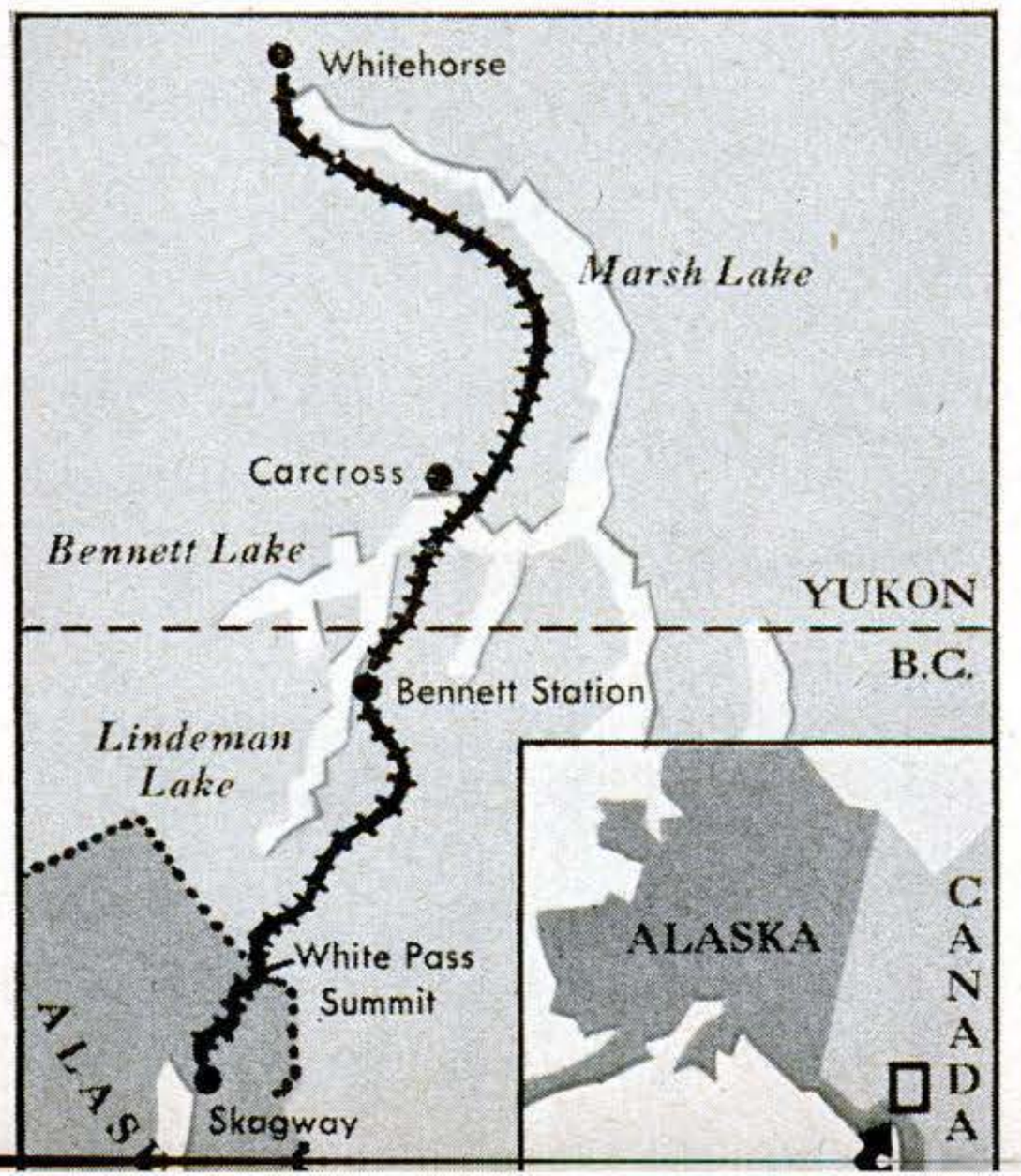
By Richard L. Neuberger

IN THE Erie, Pa., shops of General Electric, workmen refer to two narrow-gauge locomotives they are building as the "Snow Plows." The blunt noses of these sleek diesels are reinforced to toss aside drifts up to two feet deep.

Along the 111-mile White Pass & Yukon Railroad, from Skagway, Alaska, to Whitehorse, Canada, where the new engines will challenge tough four-percent grades, I have seen the main line choked by snow during less than a five-minute



Built like battering rams, White Pass & Yukon



delay between the passage of a rotary and that of the mixed freight train it was convoying.

No railroad on the North American continent defies tougher terrain or more brutal weather than this 36-inch-wide system, which now faces the third titanic boom in its history. In fact, the White Pass is the only rail line to touch the Yukon or Northwest Territories, those

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diesels must give dependable service under conditions as tough as those at the North Pole.

lonely, far-flung realms of the Canadian wilderness, measuring over five times the area of Texas.

The White Pass & Yukon originally was thrust inland from Skagway in 1900 to take advantage of the Klondike gold rush. Four decades later, from 1942 until 1944, it made possible completion of the Alaska Highway by dragging countless tons of equipment from seaport to Whitehorse, colorful old settlement where the tenderfeet loaded rafts for the voyage to the diggings. Today the White Pass & Yukon serves a primitive watershed in which light-metal companies of Canada as well as the United States are competing for permission to build a fabulous hydroelectric-power project costing at least $500,000,000.

Regardless of how the rivalry is re-

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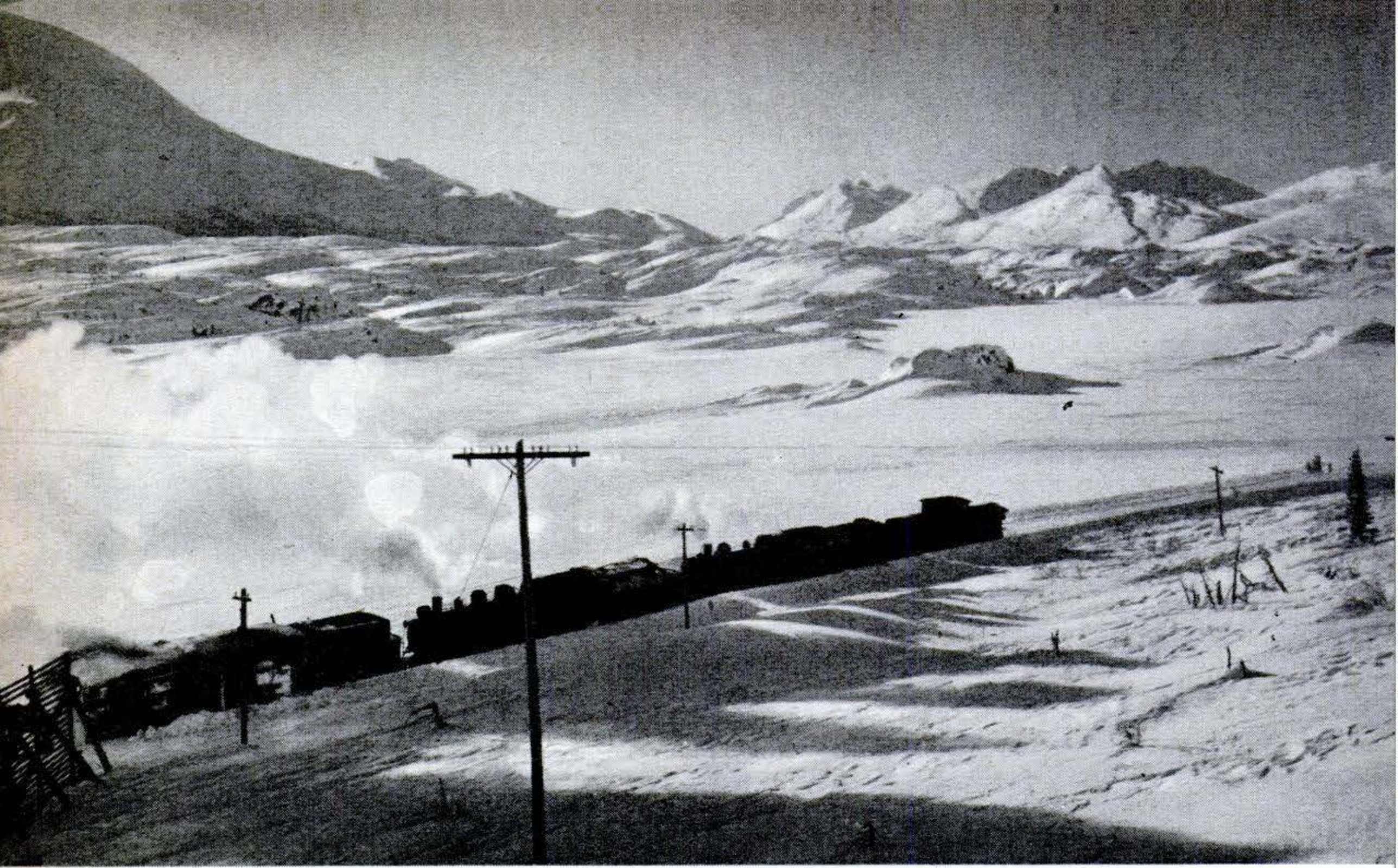

Two straining WP & Y steamers nose a rotary through choking drifts on the main line.

solved, the colossal power-and-aluminum undertaking will be a bonanza for a pint-size railroad that got its start because prospectors had struck naked, glittering nuggets of gold more than half a century ago in a bleak, frozen place called Bonanza Creek.

The first diesels in the career of the White Pass will be ready for the line's latest bonanza by autumn. One factor has dominated their design—the weather they will encounter in a land where anti-freeze has been known to stiffen in radiators, where Royal Mounties still make dog-team patrols back of plumed Huskies, and where caribou herds search for forage in the crackling glow of the aurora borealis.

Mercury Drops Out of Sight

From the beginning, General Electric had to plan box-type cabs for the pair of White Pass locomotives, because the fireman should be able to reach engine apparatus without braving the outside elements. At that, fur parkas will be rolled behind crewmen's leather seats for use in an emergency. When switcher-style construction, with its outside running board and engine hood, was discussed, White Pass officials warned that it might be impossible to break loose the engine-hood doors from their sheath of ice.

Despite its brief length, the White Pass system experiences sharp extremes in sub-Arctic weather. On the seacoast slant of the divide, it bucks relatively mild temperatures and stifling cushions of snow. Once the tracks are snugly inland from the summit, snowfall tapers off but the mercury drops out of sight.

I remember one day at the peak of construction on the Alaska Highway when Air Force recording instruments registered a grim 66 degrees below at Whitehorse, northern terminal of the WP & Y, but a balmy eight degrees above zero at Skagway, where trains are dispatched off the wooden wharves and up the forbidding hill.

One has to see the railroad hill above Skagway to believe that such a grade could really exist and, above all, be conquered nearly every day. Only the worst

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storms stop the WP & Y. In a space of 20 miles, the track ascends from ocean water at Skagway to an elevation of 2,885 feet on the summit of White Pass. Curves of 16 degrees and a maximum grade of four percent coil trains like a cowpuncher's lasso. In many places, car steps overhang sheer drops of 1,000 feet. All the gorges bellow with white water. The average grade for the 20-mile climb is 2.6 percent. Three steam engines, peppered throughout the train, are normal power on a mixed consist of one baggage car, one day coach, a parlor car, 16 loaded freight cars and a caboose.

Rotaries Clear the Way

On top of the mountain above Skagway, exposed to williwaw squalls from the Aleutians, the line may be buried beneath 40 crushing feet of snow. The

KEEPING WATER UNFROZEN for thirsty steam locomotives has previously created a troublesome problem of heating tanks all winter. Diesel-electrics won't need this service.

Snow often piles 40 feet deep beside the track, and trains drop from view in cuts like this.

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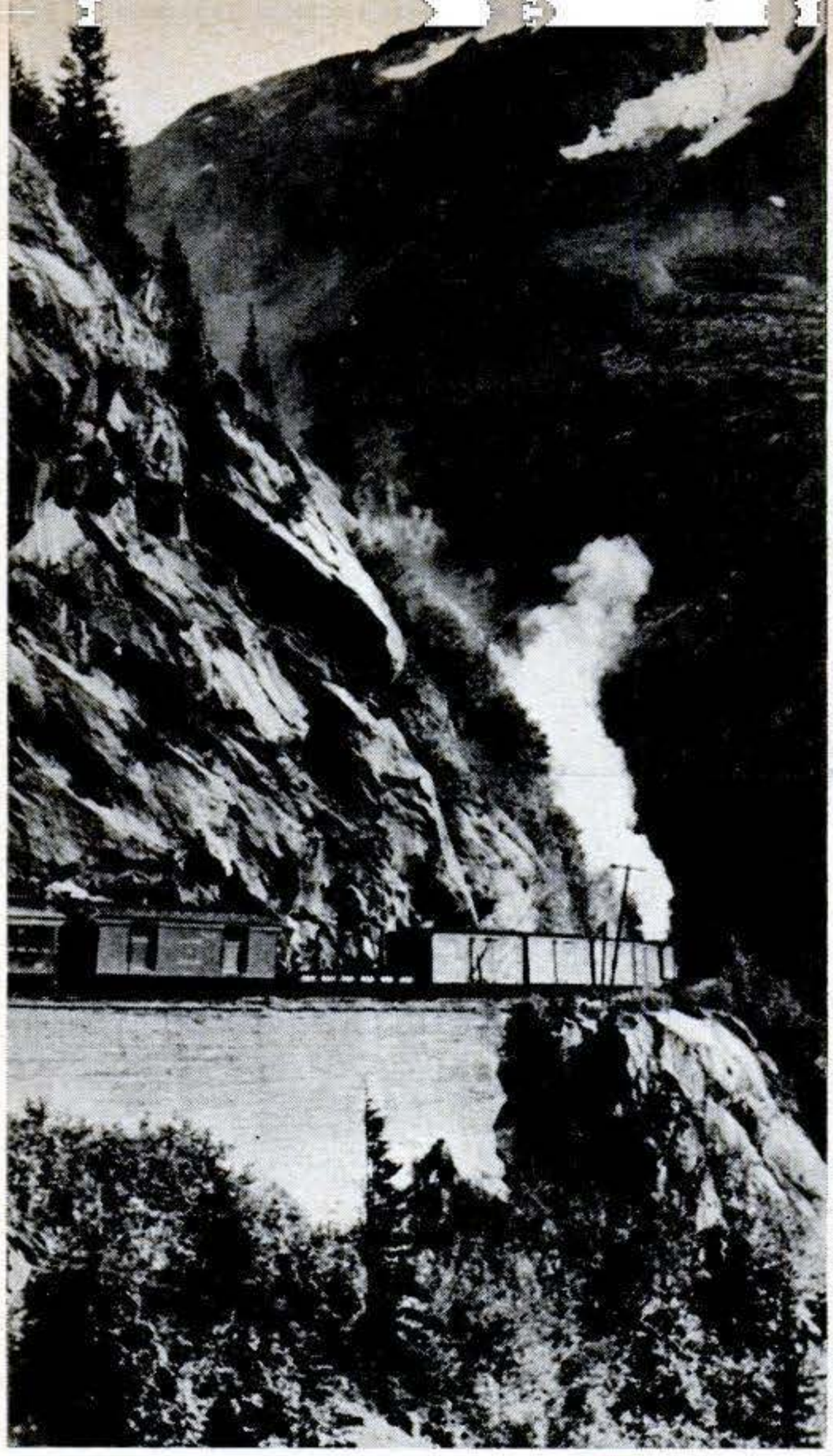

NERVOUS PASSENGERS on the WP & Y, in their parlor cars at the end of the freight train, look the other way when they round this curve on the downgrade to Skagway.

two-story station at White Pass Summit, where customs men and Mounties guard the border, disappears in drifts. The slender track is lost in the yawning cuts carved by rotary plows. Unless a rotary is run close enough to a train for red trailing lanterns to be visible, its work may do no good. Blizzards can seal a cut while an engineer is lighting his corncob.

Box Cab to Minimize Gale Impact

This explains why the new diesels will be fitted with prows of double thickness to defy the Storm King. In addition, all outside piping must be specially insulated. Fuel must be preheated and engine cabs lined with extra layers of metal. Storage batteries will need protection in the form of surrounding pipes which contain engine-cooling water. With a box cab, apparatus in the engine compartment will have a larger air cushion between it and the hood than would be customary with a road-switcher type of construction. This will minimize the impact of gales of Himalayan intensity.

Every piece of equipment on the $145,000 diesel-electrics for the narrow gauge must be shielded from conditions actually colder than those that Admiral Peary endured on his trek to the North Pole.

Each locomotive will measure 39½ feet from coupler to coupler. It will roll on a pair of six-wheel swivel trucks. The rating of the diesel engines is 800 horsepower. The units weigh 80 tons apiece. Because the emphasis will be entirely on tractive effort up the continent's stiffest railroad grade, top pace of the streamlined beauties is to be merely 40 miles an hour.

Diesel-Electrics Will Pull 250 Tons

"We want these engines to get tonnage over the hill, not win a cross-country speed derby," said C. J. Rogers, veteran white-haired president of the WP & Y.

Rogers predicts that each of the new G.E. diesel-electrics will pull a gross of 250 tons from Skagway to the top of the pass. This contrasts with a peak load of 190 tons by a 70-class steamer, which Rogers describes as "the best narrow-gauge steam locomotive ever put together." Baldwin turned out these engines for the White Pass in 1937.

Though only 111 miles long, the WP & Y is as long as it has to be. It extends from an ocean port to the head of navigation on the Yukon River. The railroad operates stern-wheelers and cargo barges over the foaming waterway, through Five-Finger Rapids, to Selkirk and Dawson and other mining settlements. Near Whitehorse, the 36-inch-gauge crosses the Alaska Highway, so the railroad likewise runs buses on the 1,523-mile road from Dawson Creek, in British Columbia, to Fairbanks.

As the principal land gateway to the Yukon, the WP & Y is very much a thriving institution. It owns 297 freight cars, 17 parlor cars, seven express cars and four coaches. The parlor cars have

[Continued on page 284]

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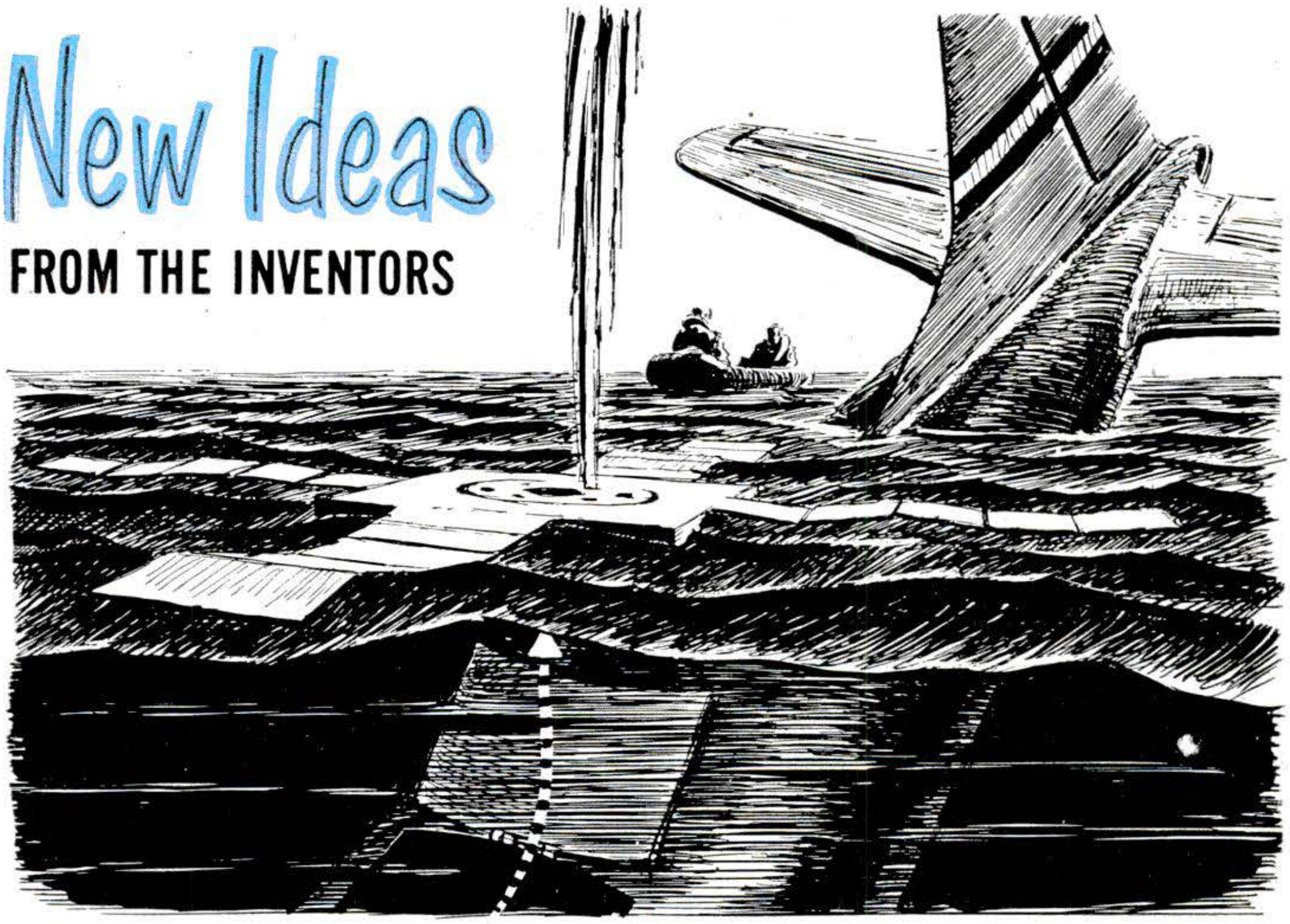
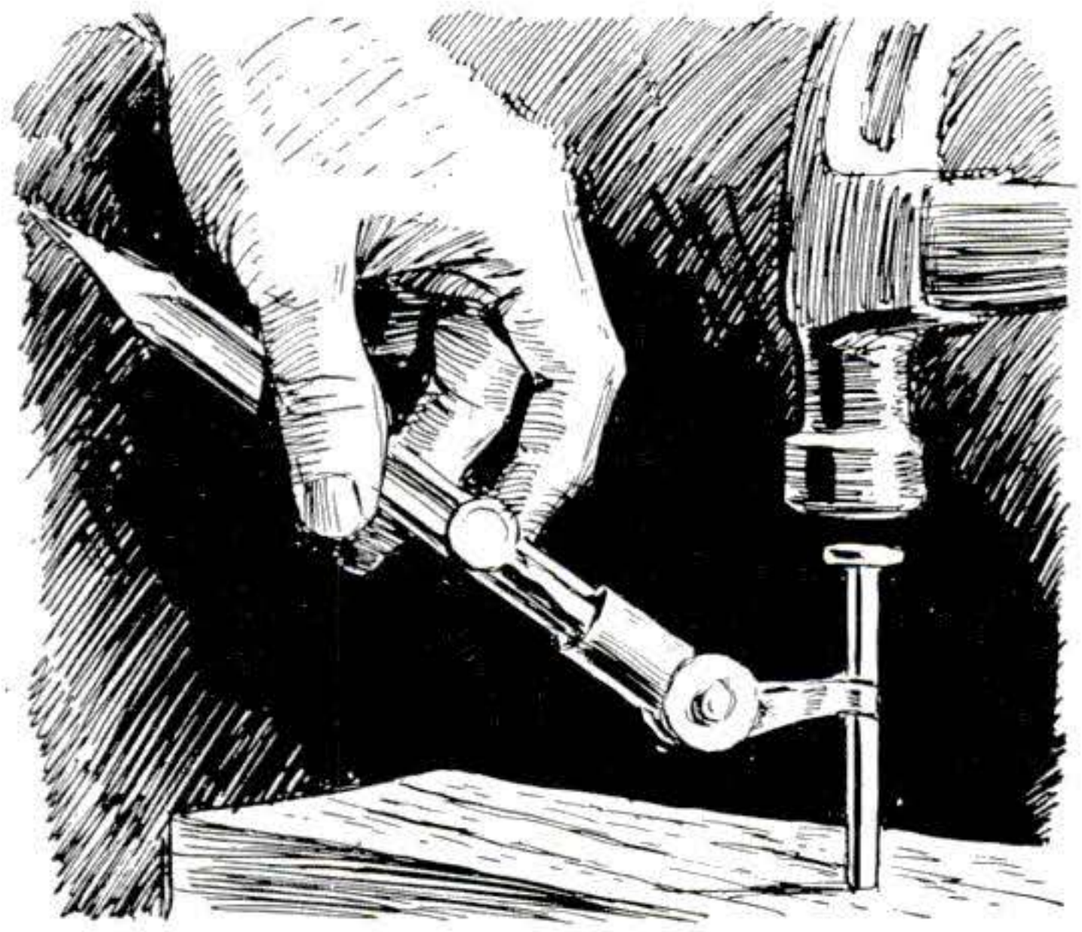
New Ideas
FROM THE INVENTORS



1 Marker to Guide Air Rescuers. The search for survivors of plane- or shipwrecks might be aided by a floating position marker and automatic signal flare. This device would be housed in a fuselage or deck compartment. If a plane struck water or a boat submerged, it would float out and uncoil a large cross visible from the air. Batteries and a timing mechanism would set off flares at predetermined intervals.



2 Magnetic Holder to Start Nails. V-shaped, magnetized fingers on this pencil-cap nail starter would hold a nail of any size in position for the first hammer tap. The magnetic gripper would eliminate danger of painful accidents, steady nails in hard-to-reach spots, and handle brads that are too short for a man's fingers.

3 Wiper to Clear Side Window. You wouldn't have to peer through a rain-clouded window if your car had this wiper attachment. A metal channel, screwed to the frame between vent and window, would form a track for the blade support and a removable handle. The handle could be unpinned to permit full closing of the vent.

Please turn the page for more new ideas.

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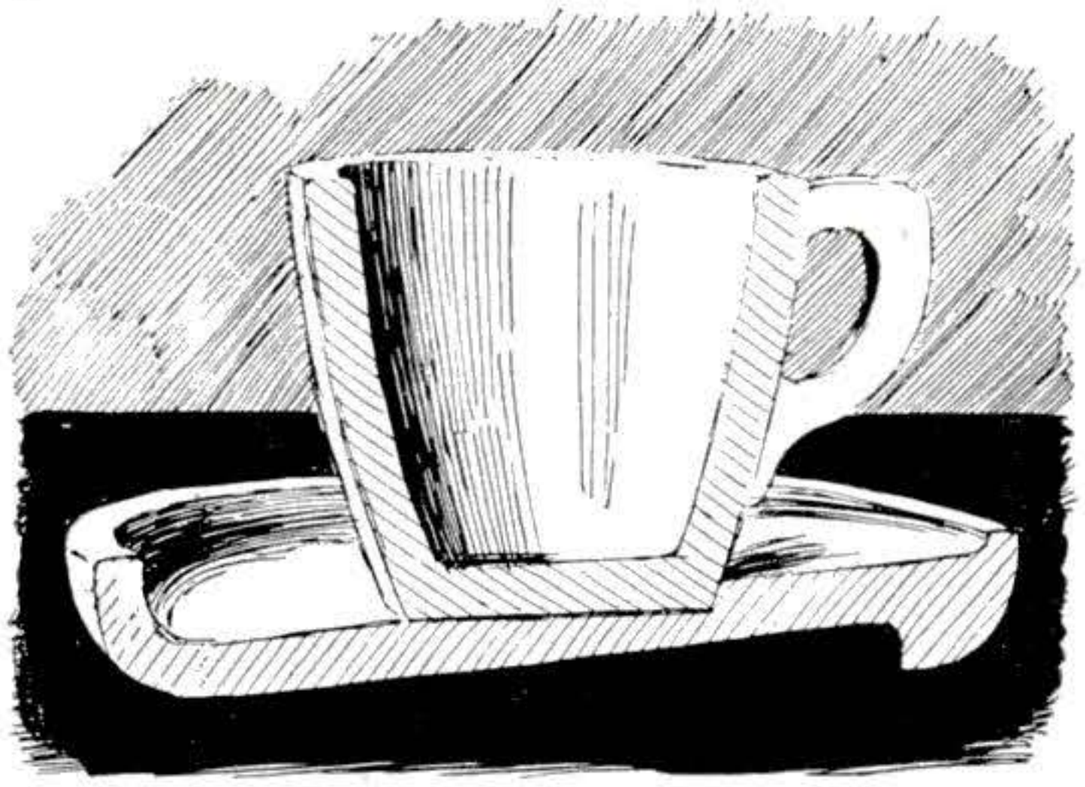
MORE New Ideas from the Inventors



4 Saucer to Keep Cup Dry. Coffee or tea that sloshed into this saucer would not drip onto table or clothing when you lifted the cup. The sloped outer surface of the dish would drain spilled liquid to one side and keep the cup bottom dry. A platform in the center of the saucer would support a matched cup in normal position.

5 Bit to Brace Camera. Instead of leaning a camera against his cheek or chin, a photographer who used this "dentapod" could steady the picture box by gripping a bit between his teeth. A bent metal bracket would attach to the camera's tripod socket. Bit height would be adjustable so the user could set the view finder at eye level.

6 Dental Switch to Say "Ouch." You can't talk back to a dentist when he's hard at work, but with this gadget you could at least tell him when it hurts. A switch held by the patient would flash a "pain" signal. Or it could be set up to give the signal and disconnect the drill at the same time. Even if the switch were not used, the patient would feel better for having it.

7 Gun to Inject Tire Patch. It isn't necessary, says this inventor, to remove a tire in order to repair a puncture or stop a slow leak. Instead he would inject an air-setting latex paste through the hole left by a nail, tack or the like. If the tube is partly inflated, he claims, the rubber composition will spread evenly and seal both tire and tube permanently.

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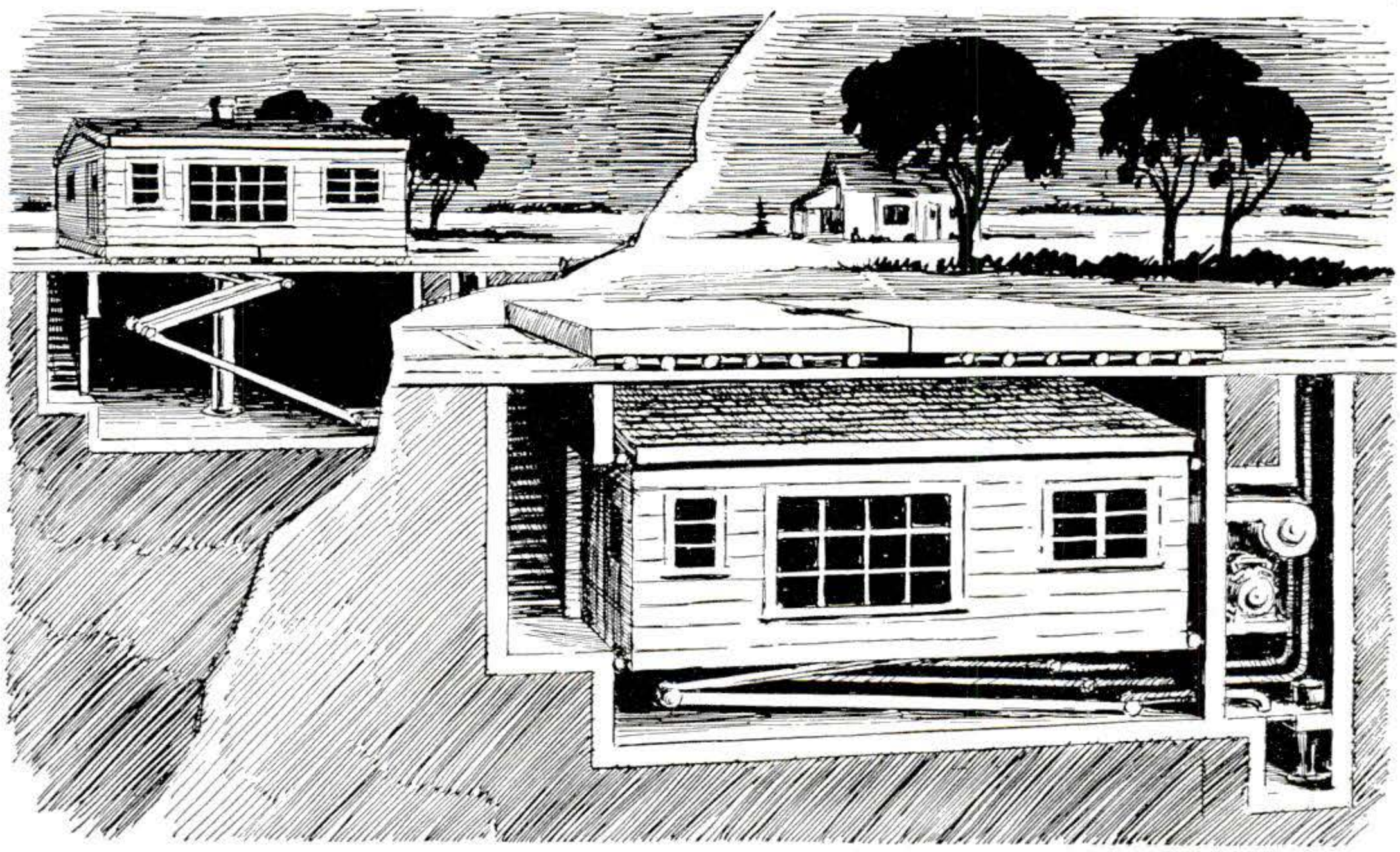
8 Can to Cook Its Own Contents. Campers could enjoy hot meals without bothering about campfires if they carried food in self-heating cans. This one would have a false bottom containing a cake of chemical fuel. It would be friction-ignited by a twist of the can bottom. A removable metal seal would prevent accidental twisting.

9 Periscope to Widen Rear View. A pair of mirrors in a car dome would eliminate usual blind spots and reflect an unobstructed, wide-angle rear view onto a third mirror mounted on the dash. Extra sets of mirrors, properly angled, would widen the range of vision still further, giving a driver a panoramic rear and side view.



10 Building to Duck Underground. This house would duck into an air-raid shelter along with its owner. Normally, the retractable structure would rest on roller-mounted concrete slabs. In the event of an air raid, the slabs would be rolled out from under, permitting the house to be lowered by a hydraulic elevator. The concrete floor would then slide back over the shelter. Ducts and swivel-jointed pipes, would maintain normal ventilation, plumbing and utilities in the underground house.

U. S. patents on these inventions have been granted to: 1. M. Sesera, West Orange, N.J.; 2. R. Ingraham, San Antonio, Tex.; 3. V. Fineo, Brooklyn; 4. R. Hudson, Madison, N. J.; 5. P. Calhoun, Gainesville, Fla.; 6. M. Grögl and A. Roe, Barranquilla, Colombia; 7. C. Notz, Englewood, Colo.; 8. J. Miron, St. Laurent, Quebec; 9. R. Darroch, Detroit; 10. W. Rowles, Santa Monica, Cal.

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Gun-Bristling Tank Is Floating Arsenal During Ferry Trips

No sitting duck is this M-47 medium tank when it has to be transported across rivers or other small bodies of water. Securely moored to a center platform surrounded by a series of sectional floats, the armored vehicle's own 90-mm. guns can be fired to protect it against enemy attack during the ferry trip. Army Engineers developed the flotation device, shown above being towed by a powered craft.

Husky Retriever Rescues Tanks

To haul disabled tanks and heavy gun carriers off the battlefield fast and under fire, the Army has developed this powerful, armed T-51 tank retriever. Dragging one tank, as shown at left, is child's play for the vehicle, says the Army. It has enough muscle to tow three medium tanks over rough ground at the same time.

A.A. Gun Mounted for Mobility

Secrecy cloaked the development and production of this new defense weapon, a twin-40-mm. antiaircraft gun, shown at right when it was recently allowed to pose for photographers. For mobility, the gun is mounted on an M-42 motor carriage.

▶▶▶Palomar's 200-inch telescope has filmed stars 6,300,000 times dimmer than the dimmest visible to the eye. A meter so sensitive it could pick up a candle flame 15,000 miles away checked the scope's performance.

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Scattier than ever, this gocart not only takes off in a hurry but pulls up short and handles well in a tight turn.

New Engine Zips Up Little Willys

By Wilbur Shaw
President, Indianapolis Motor Speedway

BOLT 115 horsepower onto a welded unit frame that measures 108 inches wheel to wheel, and you get the new Willys, an agile car for a tight market.

For the driver who doesn't feel like piloting 4,000 pounds of steel and cast iron down to work or the local supermarket, one of Willys' three models for 1954 may be the answer.

Heading the list is a lively hardtop, the Aero Eagle, followed by the Aero Ace, a de luxe model, built in both two- and four-door body styles. Both cars are powered by the new 115-hp. L-head six, called the Super Hurricane, and weigh

Good suspension and short wheelbase help nail car down if she breaks loose on a turn.

HIGH SEAT and big windshield put you right up where a driver ought to be. Turn your head and you can see all four fenders.

THAT SPORTY SPARE on the Eagle Custom gets the fifth wheel out of the trunk, leaving more room inside for luggage.

from 2,904 pounds to 3,058 pounds, depending on the transmission installed.

Number three in the line-up is the Aero Lark, also available in sedan and coach bodies but fitted out with standard equipment and powered by Willys' F-head 90-hp. six. Dropped from production this year are the two Falcon models and the 75-hp. L-head six that formerly ran both Falcon and Lark models.

It was a blustery day when I took a snappy red-and-ivory Eagle up through Toledo and into the rolling farmland outside the city. The wind plus plenty of traffic and low temperature made for rugged driving conditions.

High Seat Aids Visibility

Visibility in this car is excellent. The driver's position up on that chair-height front seat helps keep you alert. From the driver's position you can see all four fenders. Some people might object from an artistic standpoint to the rear-fender fins that make this visibility possible aft, but you *can* see them.

A big man would have a little squeezing to do to get under the wheel, and he might have headroom trouble both in front and back seats; but for the average-sized guy Willys has provided adequate room. Considering the shortness of the car, it has a remarkable amount of passenger and luggage space.

This Eagle moved along well through traffic, and out in the country it really flew. The Eagle and Ace with Hydra-Matic carry 26.59 pounds for each horsepower, which rivals the hottest of the Big Three.

There is plenty of push for emergencies where you need acceleration. Holding it at 70 m.p.h. along a deserted stretch of road seemed easy and natural for the car, and there was lots of pedal left. In fact, here is a car in which you're going to have to exercise the caution you should use when driving any vehicle. The Eagle's high power-to-weight ratio plus that comparatively short wheelbase and hefty layout of brakes combine to make a hot demisized car that will stand you on your head if you don't watch the corners and fast stops.

I would call the car quite well shocked. It's a bit stubby at low speeds, owing partly to the short wheelbase, but when you get up to road speeds the ride smooths out nicely. Willys engineers went after the ride problem in this model by redesigning shock-absorber mounts and replacing the old horizontal seat springs with vertical coils. To take the jounce of the heavier engine, extra-long front coil springs were lengthened even more and shock absorbers were remounted. Both fore and aft seats are set so far forward in this car that I suspect passengers in both positions have the same ride.

Back in town the Eagle showed its stuff in maneuverability. It's nice to be

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'54 STYLING CHANGES include new head-lamp rims, new tail lights and hubs, outside spare, and a bigger rear window. Front grille is slightly altered, to allow space for longer engine. Styling of this Aero Eagle hardtop conceals the fact that wheelbase is only 108 inches.

able to turn around in an average street with one twist of the wheel and ease into parking spaces other drivers have to pass up with teeth gnashing. Yet, in my book, the hardtop's steering was too slow for a car of its weight and length. This year Willys is offering the customers power steering as an optional extra.

Willys stylists edged around a major body change by a matter of a scant inch or so. The new 226.2-cubic-inch engine is about 3½ inches longer than the 161-cubic-inch power plant it replaces. This could have meant extending the car's length by that amount. But instead of lengthening the hood or letting the new Super Hurricane stick back into the driver's compartment, designers simply notched out the old deep-set grille and reworked the front frame cross member. Only noticeable changes are two fins on the grille cross foil, and even these are mounted back in the opening flush with the new radiator which they brace.

Willys has gone after the ventilating department in a big way for 1954. One of their exclusive features is the air-intake and blower system that has two open-air ducts instead of one. With this setup the heater will give you fresh air directly into the car and also fresh air through the heating core. The blower system lets you have fresh cold air through the defroster to get rid of fog faster; it recirculates inside air when you're going through heavy traffic or dusty areas; and in winter it supplements warm air coming through the second duct. END

FACTS ON '54 WILLYS

Model: Aero Eagle hardtop two-door sedan.

Engine: 6-cyl. L-head; 115 hp. at 3,650 r.p.m.; compression ratio, 7.3:1; piston displacement, 226.2 cu. in.; bore and stroke, 3 5/16" by 4⅜"; torque, 190 lb.-ft. at 1,800 r.p.m.

Weight: 3,058 lb.; per hp., 26.59 lb. (with Hydra-Matic).

Transmission: standard, three-speed manual shift; overdrive or Hydra-Matic available. Rear-axle ratios, 3.54:1 (standard); 4.10:1 (overdrive); 3.31:1 (Hydra-Matic).

Steering ratio: 23.7:1; radius of turning circle, 19'.

Effective brake-lining area: 132.81 sq. in.

Springs: front, coil; rear, semi-elliptic, 7 leaves 2" by 48".

Outside dimensions: height (loaded), 60"; over-all length with bumpers and guards, 180⅞"; width, 72"; wheelbase, 108"; overhang, front 32", rear 40 8/10"; tread, front 58", rear 57".

Inside dimensions: seat-cushion width, front 61", rear 61"; leg room, front 42½", rear 38½"; headroom, front 35½", rear 34"; seat height, front 12¾", rear 12½"; vertical distance, steering wheel to seat cushion with seat in mid-position, 5½"; front-seat adjustment, horizontal 4".

Tire size: 6.40 by 15.

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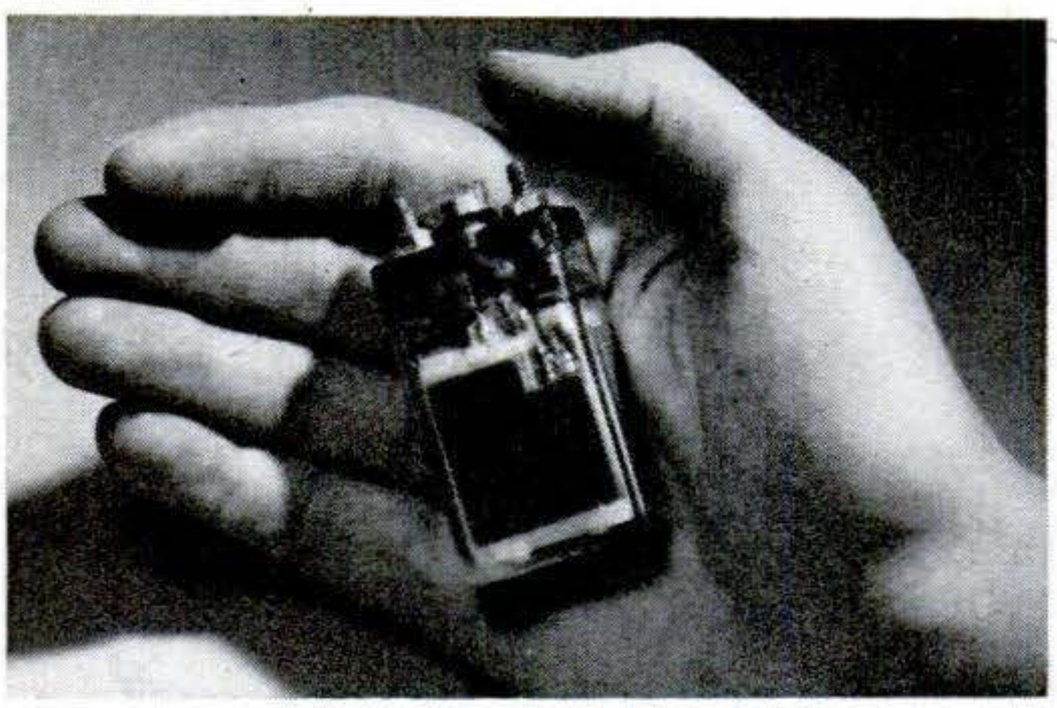
Cancer-Treating Machine Uses Dummy as Stand-in for Patients

A WOODEN dummy helps set the right dose of cancer-killing rays from this powerful betatron, only part of which shows at top of photo. The dummy, designed to simulate the density of human structure, is made in sections so that penetration to different parts of the body can be measured. It is used at Memorial Center in New York City.



New Battery Is Small and Light

A NEW nickel-cadmium battery, about half the size of a conventional storage battery, will become available this year for cars, boats, planes and farm machinery. It uses sintered plates, plastic and fabric separators and plastic cells like the small one above. Though it will cost from two to five times as much as a lead-acid battery, its maker, Sonotone Corp. of Elmsford, N.Y., says it will last longer.

Plastic Car Tops 100 M.P.H.

AN ENGINE of only 60 horsepower drives this little Jowett Jupiter sports car at more than 100 miles an hour. With overdrive fitted to the four-speed transmission, the car can make nearly 120 m.p.h. The body is of plastic, and the one-piece hard top can be removed to convert the car into an open model. The windshield also can be taken off. The machine is made by Jowett Cars, Ltd., in England.

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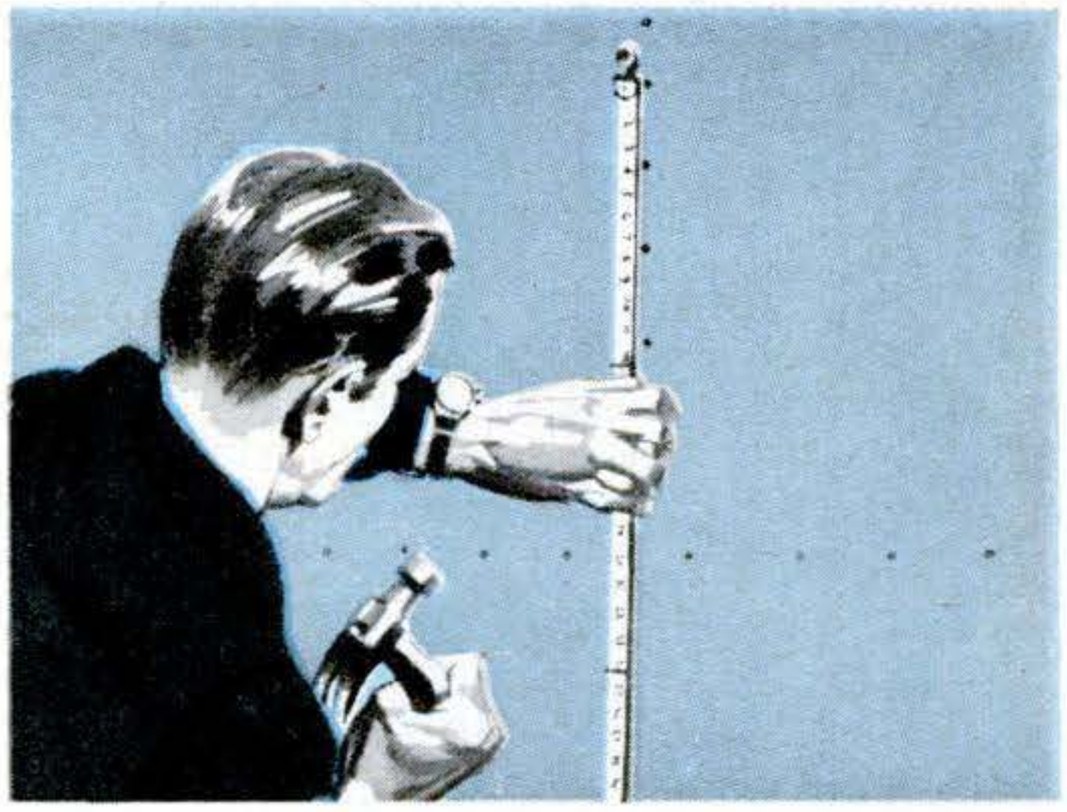
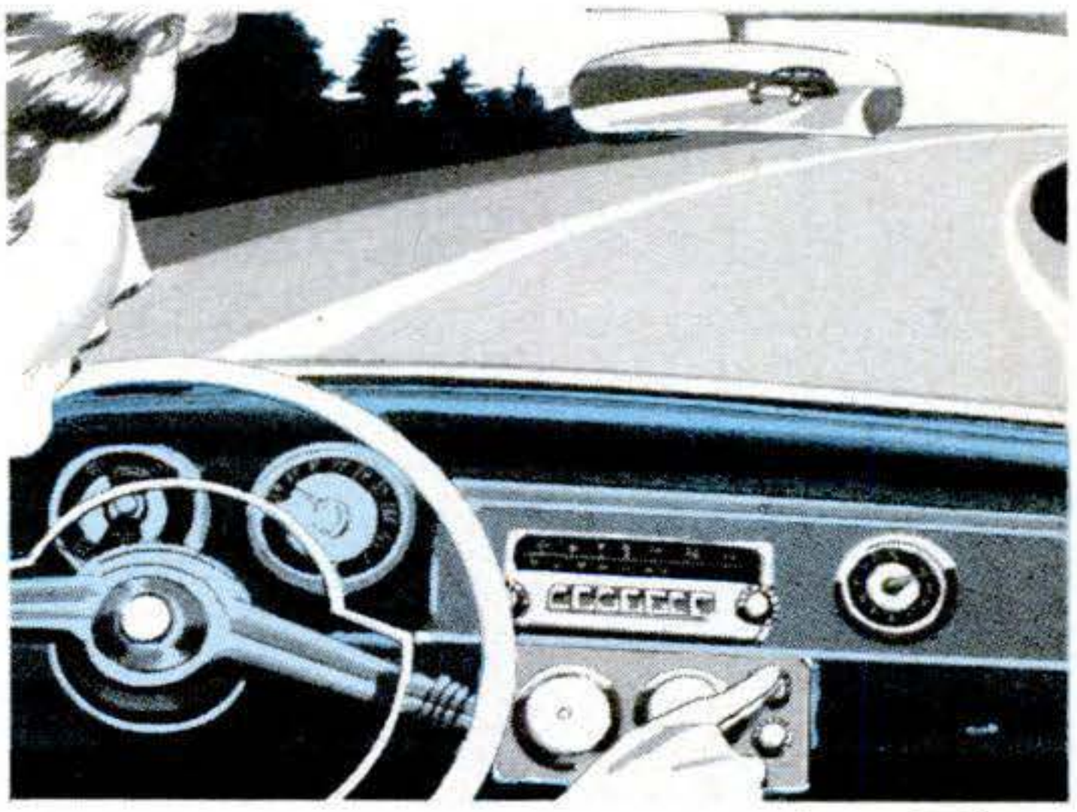
I'd Like to see them make...

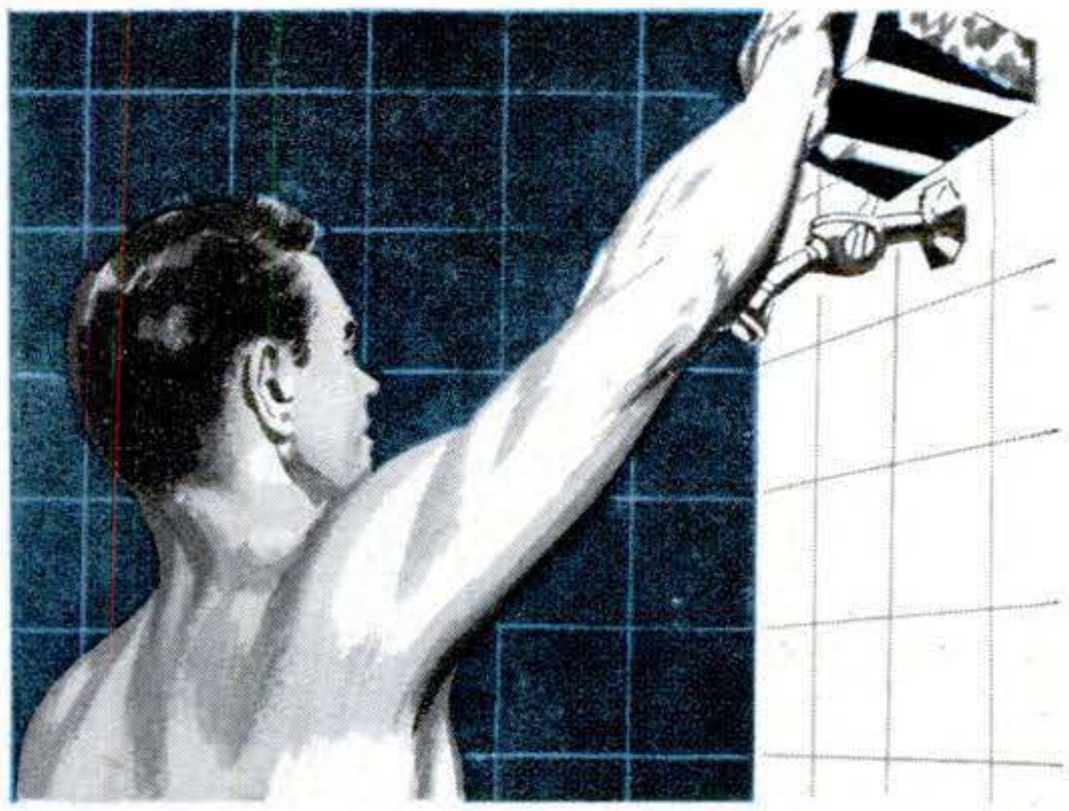


A FOLDING RULE with an eyelet at one end so it could be hung as a rough plumb for wall-papering, tracing studs for attaching wall-board and the like.—*A. Bane, Kennett, Mo.*

PLAY-PEN MATS like electric blankets. They'd be fine in early spring when house heat is turned off, leaving floors too cool for a baby.—*Mrs. S. Milazzo, Cincinnati.*



TAPE-RECORD PLAYERS on car radios. When you hit poor radio reception or uninteresting broadcasts, you could switch on the cartridge-loaded player.—*A. P. Sabol, Warwick, Va.*



A SELF-SOAPING SHOWER. A dial-operated, built-in container to feed soap to the water stream would eliminate the job of hanging onto a soap bar.—*S. Skalka, Brooklyn.*

CIGARETTE-LIGHTER FLINTS that give off colored sparks as a warning when worn down to the point where a replacement is about due.—*G. L. Albertyn, Johannesburg, South Africa.*

Everyone has his own pet idea of a gadget he would like to see in general use. The five ideas illustrated above were suggested by PSM readers. What is YOURS? We will pay $5 for each one published. Please use government postcards only. Contributions cannot be acknowledged or returned.

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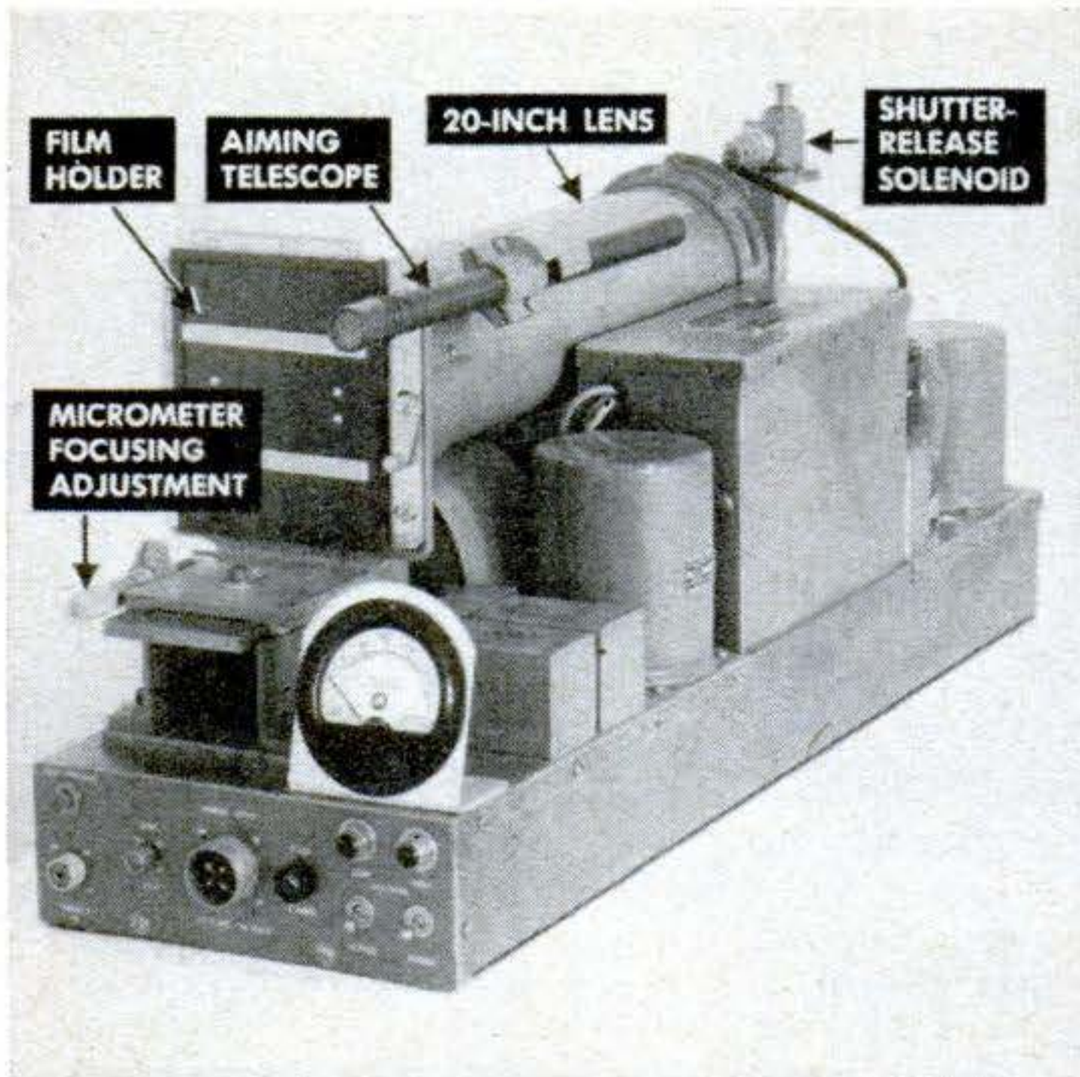

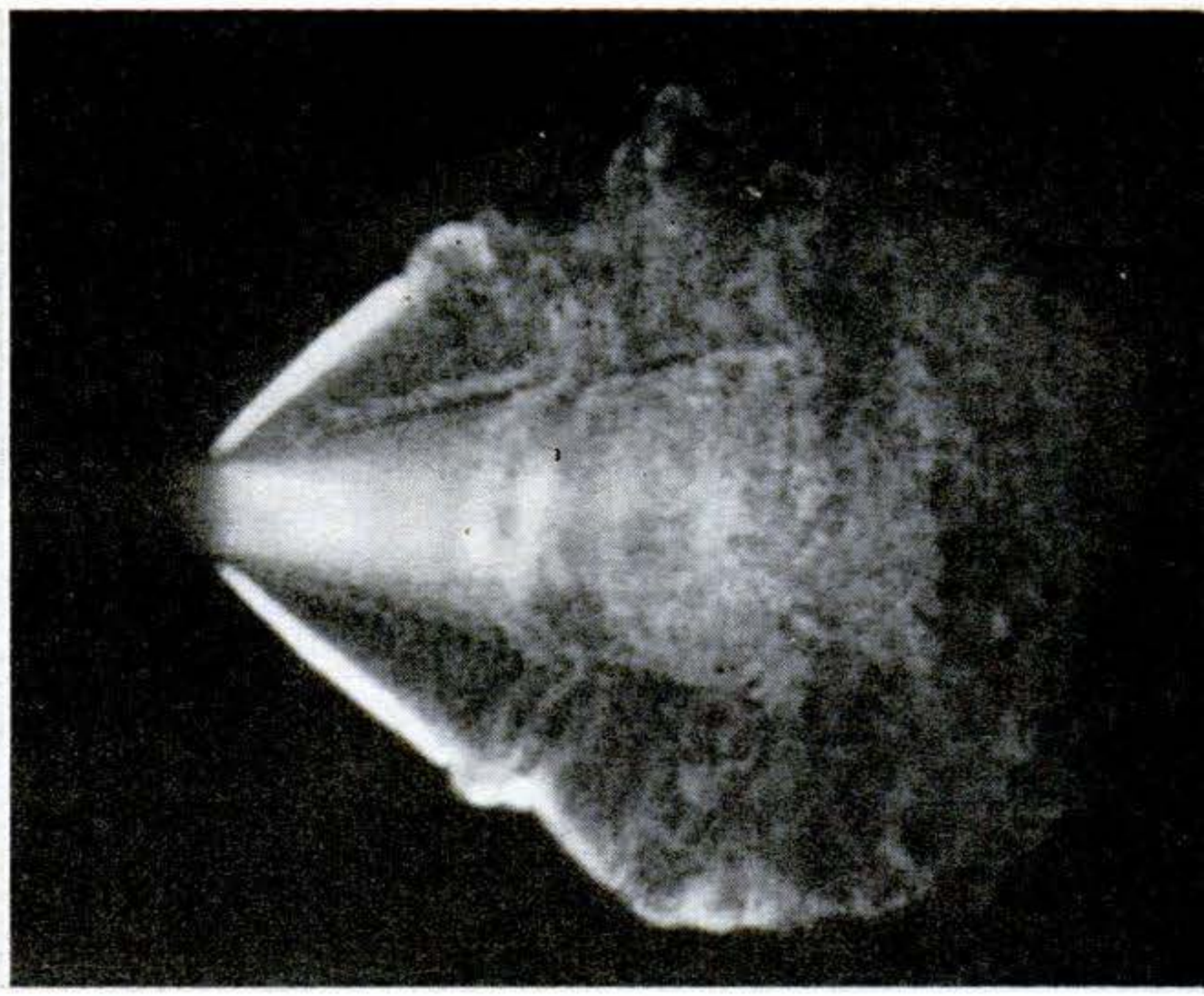

Electronic Camera Snaps New View of Explosions

EXPLOSIONS look different when snapped by a new electronic camera. That's an A-bomb blast—minus the familiar mushroom—at far right above. The center pictures are

Truck Checks Speedometers

A SPEEDER on Holland's highways can't say he didn't know how fast he was going because his gauge was out of whack. Technical-assistance trucks cruising the roads to aid tourists in trouble display huge speedometers so drivers can follow and check the accuracy of their own dial readings.

▶▶▶Tiny balloons, so small it takes 770 of them to span an inch, may save millions of gallons of oil from loss by evaporation. The plastic, nitrogen-filled microballoons are poured an inch thick on crude oil in storage tanks to seal it off. Standard Oil Co. (Ohio) says the floating cover, rising and falling with the oil level, cuts evaporation from four to about one-half of one percent.

Phone Booth Frees Both Hands

THIS lady is making a phone call from an experimental booth set up in Boston's South Station. She hears through a recessed speaker (at her left ear) and talks into a mike jutting out beside it. There's an on-off switch and a volume control but dialing is done by an operator outside the booth.

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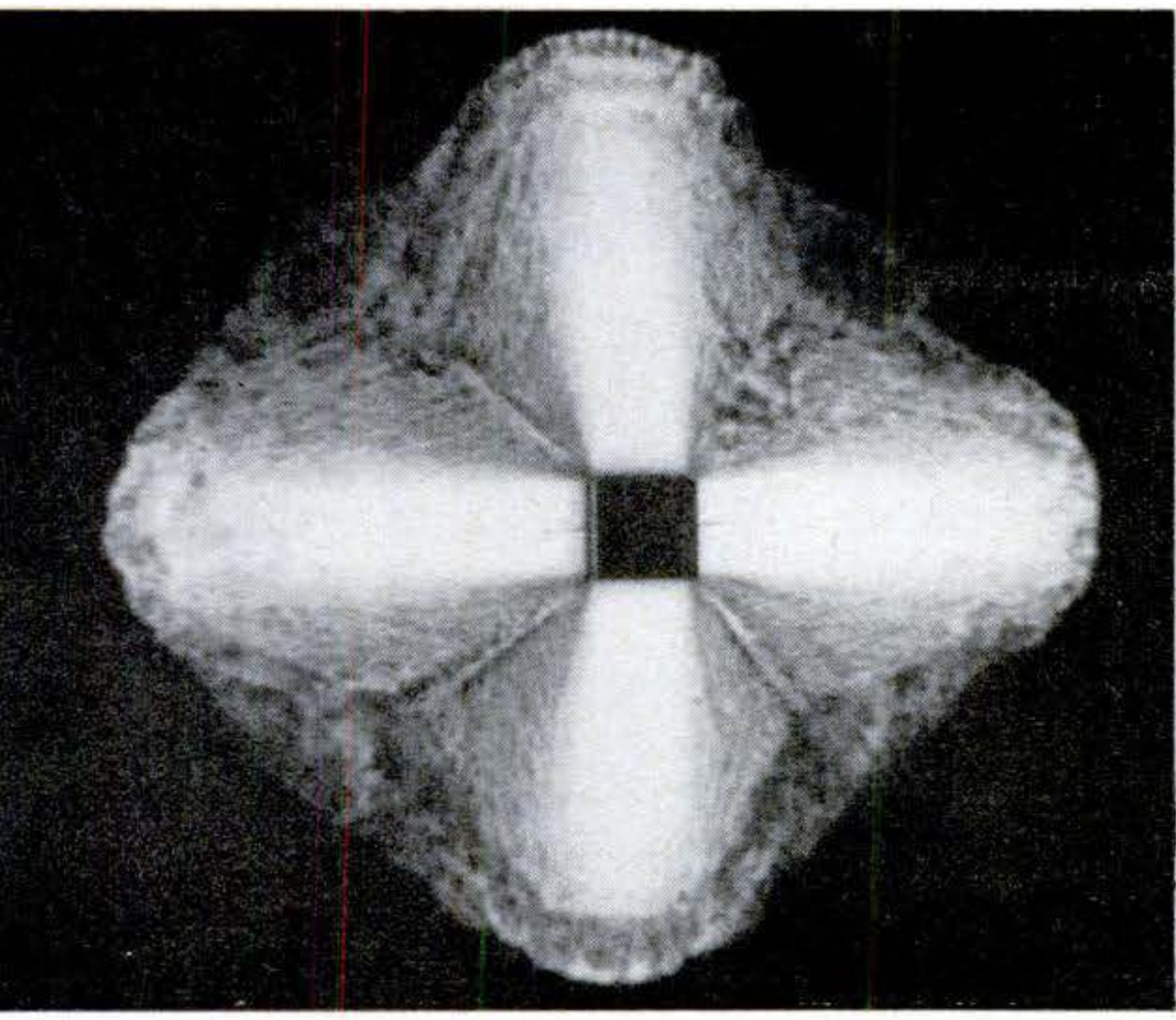
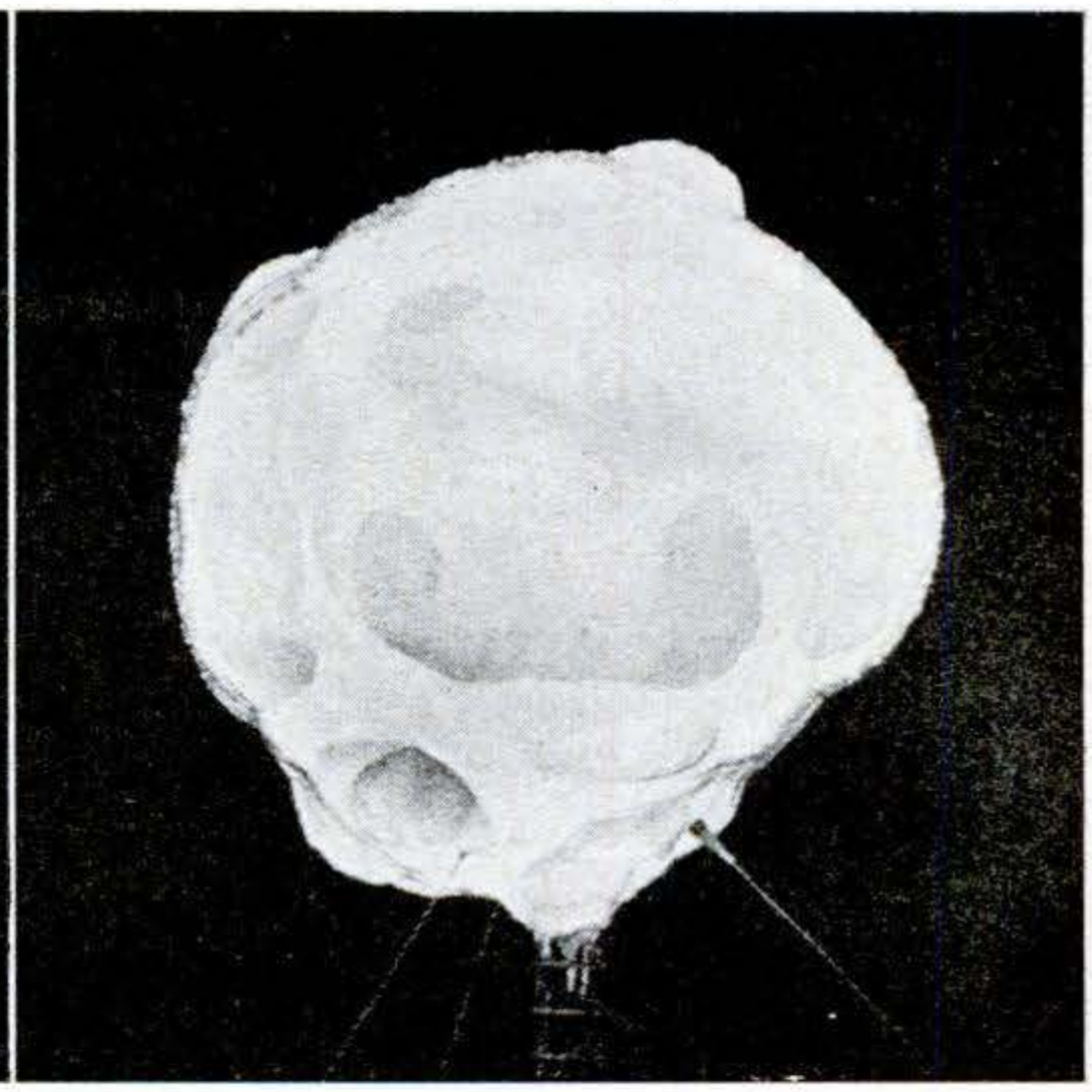
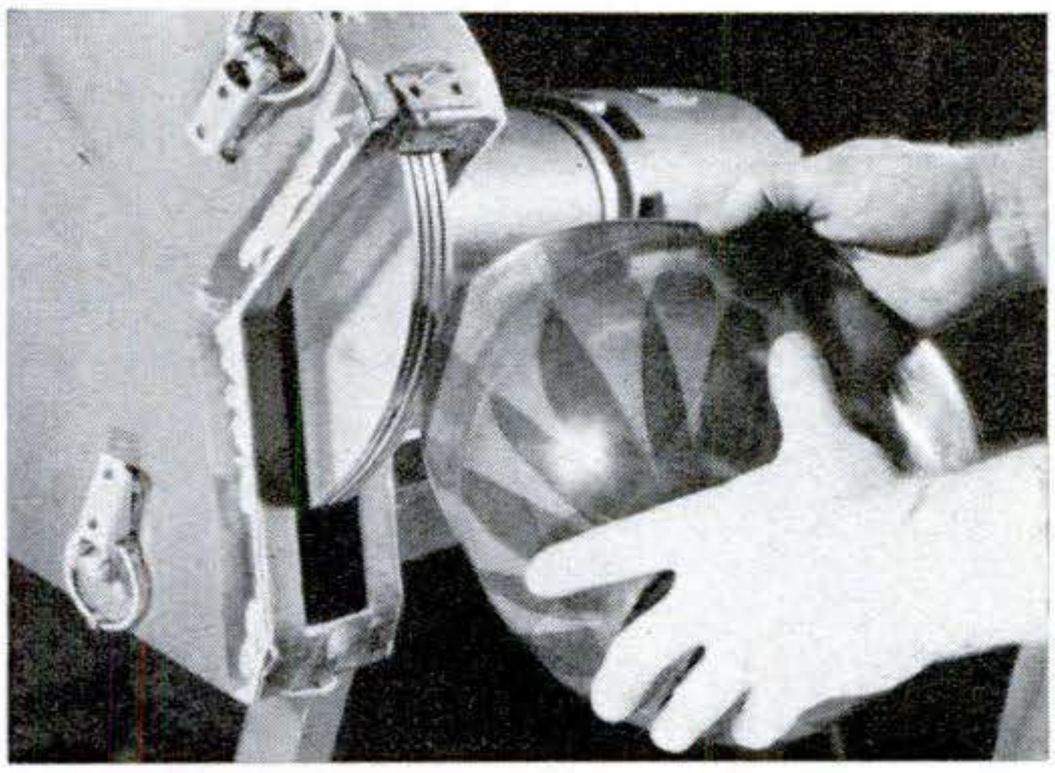




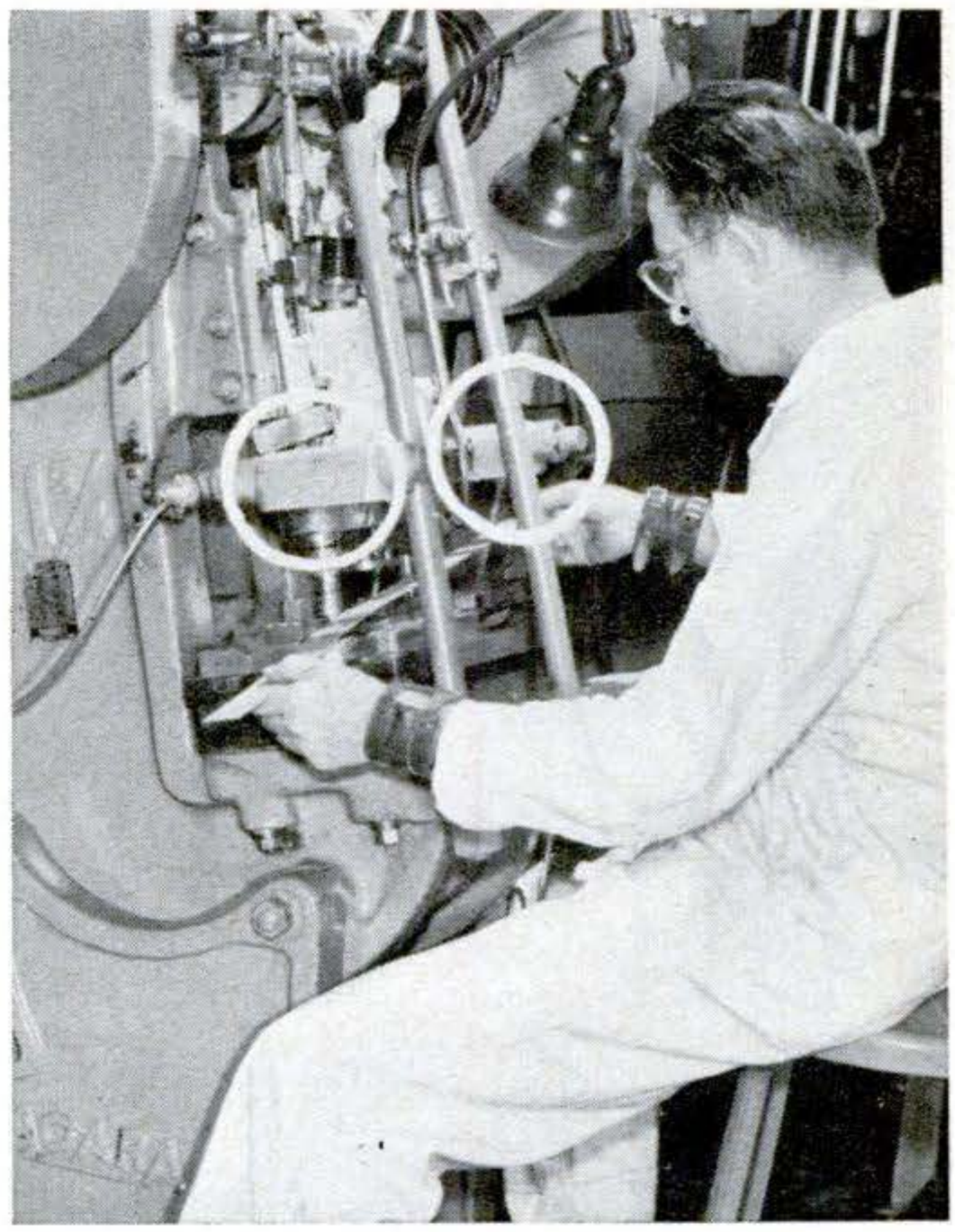
side and end views of detonating sticks of pentolite. All were caught in a few millionths of a second by the Rapatronic, which has a shutter of "crossed" Polaroids that keep light out except for the instant when the polarization of the light is changed by a magnetic field. It was developed by Edgerton, Germeshausen & Grier.

▶▶▶Instead of lighting the fuse in each drill hole separately, mine blasters now stay at the loaded face only long enough to light a single fuse. This igniter cord lights the individual charge fuses in rotation. The igniter cord—said to be more satisfactory than electricity for detonating the holes—is being used in Canadian mines of the International Nickel Co.



Glass Wheel Polishes Plastics

A NEW burnishing wheel pits plastic against plastic to smooth and polish molded products like the helmet liner above. The resin-impregnated, glass-fiber wheel has parallel grooves in which grinding is done to remove "flash." Previously, grinding and polishing were done on separate equipment.



Hot Crystals Guard His Hands

THE punch press above won't wham down on the operator if his hands stray into the danger zone. Geiger tubes (circled) pick up radiation from hot crystals in his leather wristbands to halt the punch even in mid-stroke. United Airlines uses the safety device at its San Francisco maintenance base.

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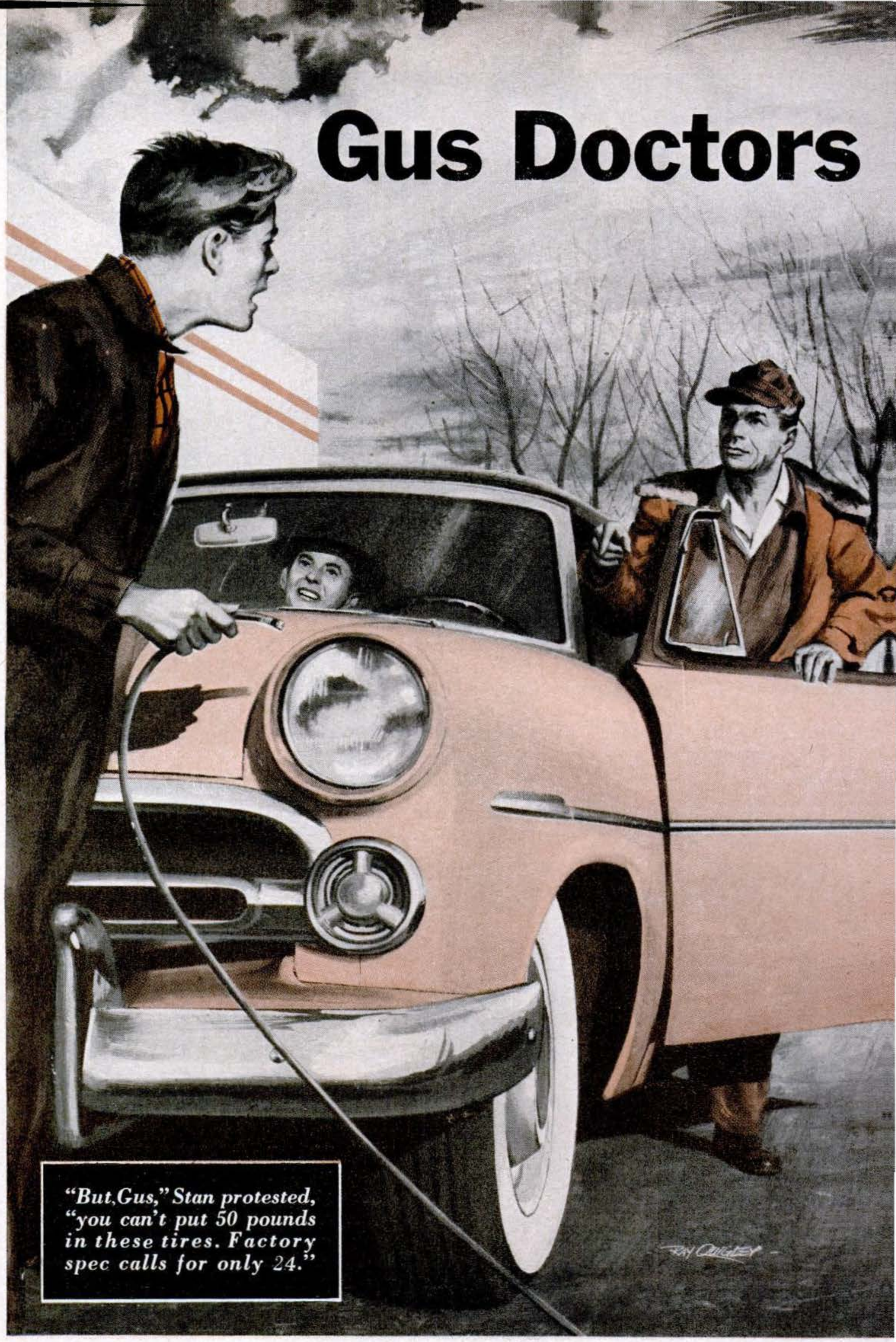
Gus Doctors



"But, Gus," Stan protested, "you can't put 50 pounds in these tires. Factory spec calls for only 24."

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a Case of Jitters

With an ex-GI's reputation at stake, the Model Garage uses high-pressure methods on a car with the shakes.

By Martin Bunn

ALF MADSEN'S loose talk, soon after he returned from service in Korea, bothered Gus Wilson. Madsen drove that car of his around town as he had piloted his jet fighter overseas—fast and flashy.

And he complained. That was the nub of the problem. If he didn't button his lip, there was going to be trouble.

That is, there would be trouble for Big Bill Pederson. Pederson had sold Madsen the car. Pederson, too, had been in Korea. Now he ran a used-car lot a few blocks from Gus Wilson's Model Garage.

"The car's no good," Madsen kept broadcasting around town. "It's got the shakes."

It was a cockeyed situation. Alf Madsen had been a lieutenant in the Air Force, Big Bill only a corporal in the Army Engineers. Alf was the son of one of the town's more prosperous citizens.

"If Madsen keeps shooting off his mouth," Gus remarked to his helper, Stan Hicks, "the first thing you know, Big Bill Pederson will be out of business. That kind of talk gets around fast."

"If he won't back up his guarantee," Stan Hicks retorted, "maybe it would serve him right."

Maybe, thought Gus, it wasn't that simple. Or maybe he was wasting his sympathy. Maybe Pederson didn't deserve the breaks. Funny, though, both men were running true to form. He had known them as kids. Pederson was big of frame, slow, seemingly honest. Alf always had struck him as being an okay kid. He was just bumptious.

At lunch time Gus went out of his way to drop in at Pederson's used-car lot. It was small and neat. Every car was shined and polished, with the price tag on the windshield. It didn't look like a gyp joint to Gus. Pederson came out of his small office-and-shop, a tall, wide-spanned young man, in slightly soiled coveralls.

"Gus Wilson!" he exclaimed, holding out his hand. "I haven't seen you since I got back. Every time I passed your shop your legs were sticking out from under a car. Didn't want to bother you."

A Man Has to Watch His Step

"Been pretty busy," Gus said, shaking Pederson's hand heartily. "But lately things have dropped off. I came around to see if you might have some work you could shove my way."

"Golly, Gus," Pederson said. "I'm sorry, but you see I'm running here on a shoestring. I couldn't get by unless I did my own work."

Gus eyed the neat lot. "You've got a nice little place," he said. "Should do well. The only trouble with the used-car business in this town is that a man has to watch his step. One sour deal can start folks to passing him by."

"How right you are," Pederson said

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with fervor. "That's why every sale I make has to be on the level."

"Well," Gus said, "I'll have to be moving on." He turned to go.

"Wait!" said Pederson. He moved closer to Gus. "I've been away from home so long I'd almost forgotten a few things."

"Such as?" Gus asked.

"Among other things, that Gus Wilson doesn't go around the neighborhood drumming up trade, and that he doesn't talk just to hear the sound of his voice. Just what were you getting at a moment ago?"

Gus idly knocked the dottle from his pipe.

"Been some talk," he said bluntly, "about the Madsen deal."

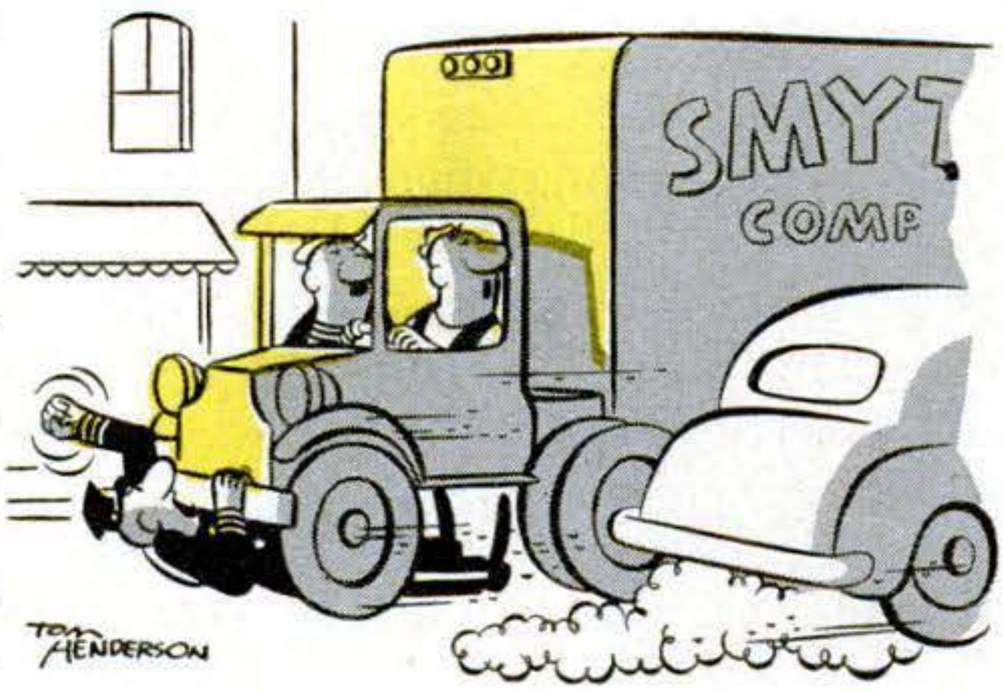
Pederson scratched his jaw. "What would *you* do about it?"

"I'd fix it," Gus said softly, "or refund Madsen's money."

"But I can't refund his money," Pederson groaned. "I took the cash from the sale and bought two cheaper cars. Believe me, Gus, I'd refund to Madsen if I could."

"Well," Gus said, "what about fixing the car?"

"I can't fix it," Pederson said angrily, "and neither can anyone else—not to take the speed Madsen drives it. I've checked it from bumper to radiator cap. There's nothing wrong with the car. It's just one of those jobs that naturally vibrate a bit at high speeds. You've seen such cars, Gus."



"Clancy must be off duty. I generally see him on that corner back there."

Gus Makes an Offer

"Yes," Gus conceded. "How about tire and wheel balance?"

Pederson snorted. "Tires and wheels balance perfectly."

Gus scratched his head. "Why not let me look at Alf's car?" he asked. He added, to save Big Bill any embarrassment, "I just want to smell around a bit. Might save me taking a licking later, when I run into one like it."

Big Bill Pederson put his hand on Gus's shoulder, while a slow smile formed on his face.

"Years ago," he remarked, "I used to come around to the Model Garage to get my bicycle fixed. I guess things haven't changed much."

Pederson brought the car in at mid-afternoon. Gus left the garage in charge of Stan Hicks, and with Pederson beside him, took the machine out on the highway leading to Stanfield. The sleek coupe purred like a kitten. It should have. It had less than 10,000 miles on the speedometer.

Gus watched the speedometer needle climb — 50-60-65-70. At 60 the car's smoothness began to fade. This wasn't something a man could tack squarely down. Gus had never heard anything quite like it, yet he realized that it was vibration.

It could be anywhere—a loose flywheel, loose or too-tight motor mounts, motor slightly out of line, loose transmission to the bell-housing studs, worn or dry universal joints, wheel bearings, out-of-balance main, or the drive shaft. A line of worry began to form about Gus's eyes.

"What did I tell you?" Pederson said.

Gus took the car back to the garage. He raised the hood, backed off the motor forward mounts, tightened them so that they were snug, but not to flatten the rubber cushioning. He put the car on the hoist, removed the flywheel cover and checked the flywheel for looseness with a bar. He tightened the studs that held transmission to bell housing, loosened the rear transmission support, wiggled it to make sure the transmission fell in line and retightened it. He greased and

[Continued on page 252]

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How to Build a Midget Tractor

You can look forward to those yard chores this coming spring with a motorized helper that takes over all the heavy work.

By Howard G. McEntee

WITH a baby tractor in the garage, Dad will be lucky to get to the chores before Junior beats him to it. This husky little power wagon lets you do the hard work sitting down, and makes fun of it to boot.

It has plenty of pep to drag a heavy lawn roller, pull a gang mower up slopes, draw a spiker or leaf sweeper, or hustle along a heavily loaded garden cart. What's more, if you want to run a power saw, small concrete mixer or water pump where there is no electricity, you can drive the tractor to the spot and take power off the engine.

The midget has enough getup to spin its wheels on a dry road, and upshifts on the run to attain respectable speeds. It is not meant for heavy work like plowing, deep cultivating or snow removal, which require a heavier frame, cleated tires and a greater engine-to-wheels reduction ratio.

If built entirely of new parts, the tractor will cost about $150, a bargain in view of what it can do. Still, careful shopping and junk-box scavenging may cut that figure by a worthwhile margin.

How the drive works. A 1½-hp., four-cycle engine, bought at a sale for $40, delivers all the torque that the tractor can

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It Drags a Spiker

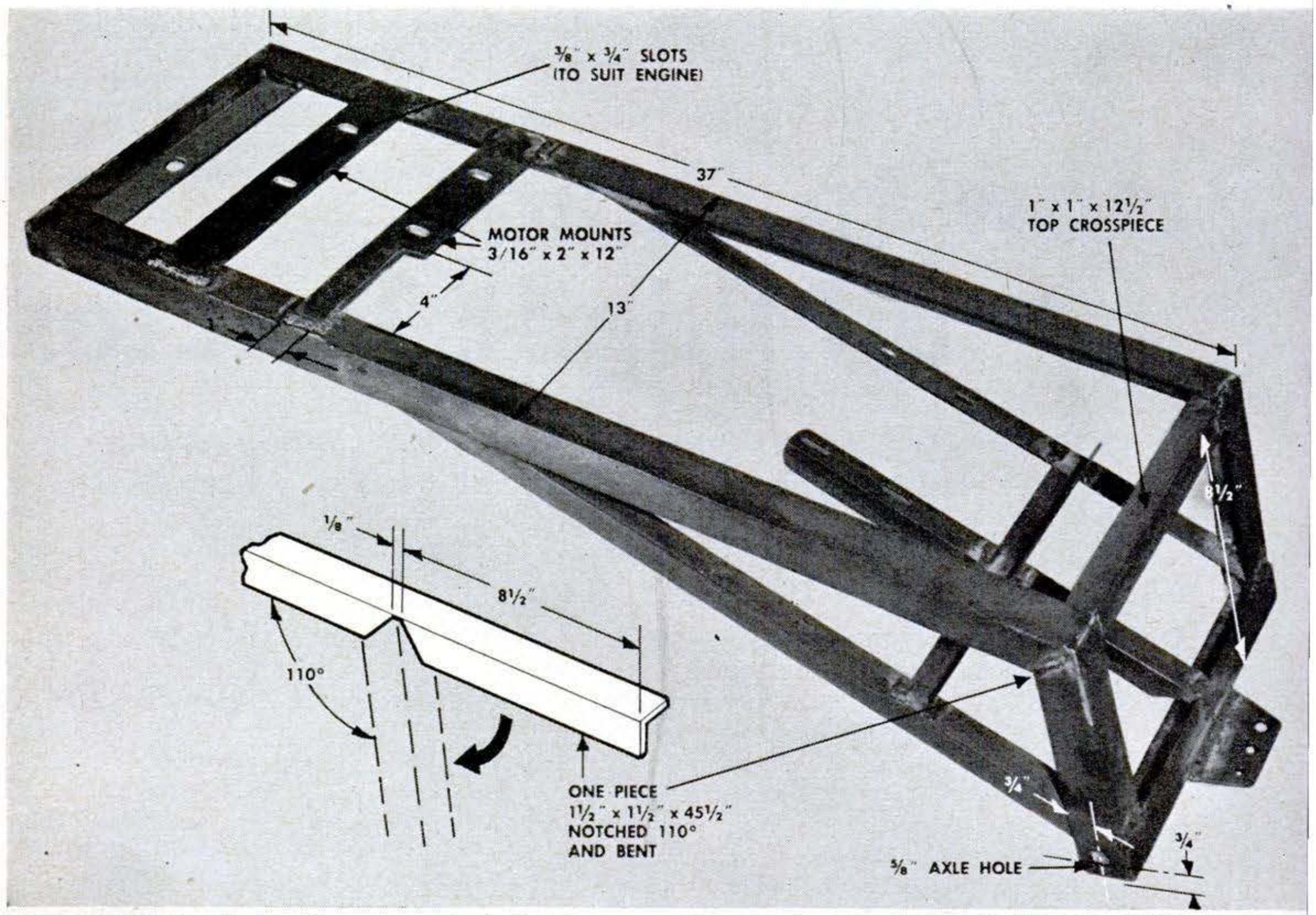
use. This power plant has magneto ignition, an air cleaner and a governor-controlled throttle. The hand throttle used by the driver merely changes the governor setting, so that engine speed remains constant at any load, an advantage on most jobs.

A used engine of similar type will cut your cost considerably, but be sure to check the engine base and make any changes in the chassis mounts necessary.

The heart of the drive system, and the solution to the knotty problem of a differential (to allow the rear wheels to turn at different speeds on curves) is an automatic double centrifugal clutch. This drives two separate countershafts, from each of which a chain runs to one rear wheel.

Each belt sheave on the clutch has one fixed flange or cone, and one movable one controlled by internal weights. When the engine is idling, the movable flanges are held back from the fixed ones and the belts are not gripped. As the throttle is advanced, centrifugal force causes the weights to pinch the flanges on the belts. As engine speed rises further, the flanges squeeze still closer and push the belt outward to a larger diameter, in effect changing the size of the drive pulleys. A pair of spring-tensioned idlers keeps the belts taut at all pulley positions.

The clutch thus provides automatic up or down shifting to suit the load, giving



LONG MEMBERS of chassis are notched, bent and welded at rear corners. Front and lower rear crosspieces are full 13" width, overlap sidepieces to form closed corners. Top rear crosspiece is shorter, fitting inside the 110° corners. Rear motor mount is narrowed for part of its length to clear belts. To make slots, drill several holes and file between.

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the tractor the equivalent of a transmission. On turns, the inside wheel tends to turn more slowly and therefore down-shifts, while the outer one speeds up and goes into "high."

There are no brakes, but the large engine-to-wheel ratio supplies ample engine braking to hold the tractor even on a hill. No reverse is needed; it is possible to back up by pushing with both feet. For close maneuvering, you can easily swing the machine by lifting the front end.

Start with the frame. This is of angle iron and can be riveted, bolted or welded together. Welding saves so much drilling, extra brackets and fussy joining that it is worth what it costs to have it done if you're not equipped to do it yourself. All the welding on the tractor shown came to $9. A welded frame will stay tight despite the shocks and torsion that it has to take in actual use.

If you do have welding done, cut and fit all parts with care and clamp them in

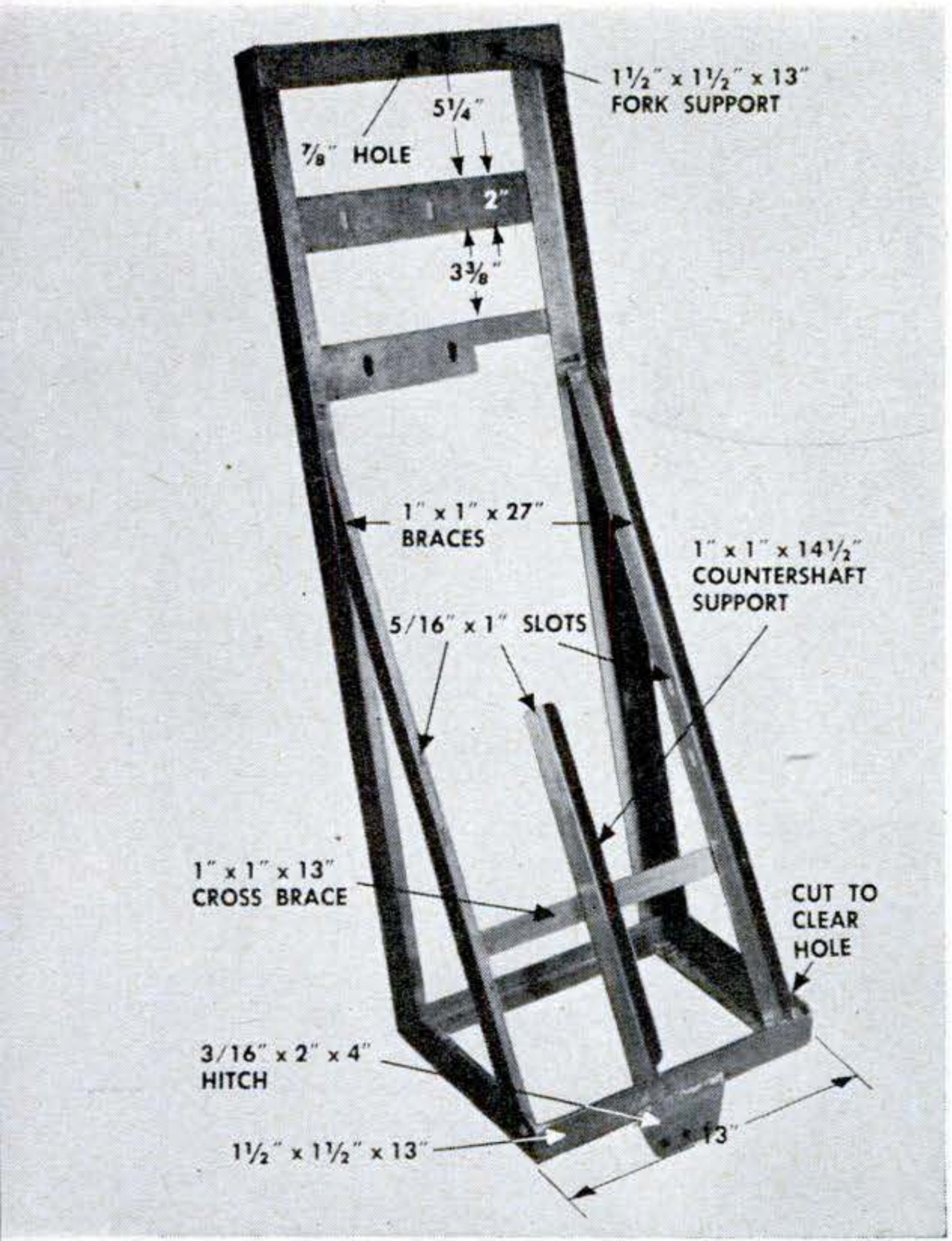
It Rolls the Lawn

position insofar as possible before taking them to the welder. The less time he needs to spend on these preliminaries the less his work is liable to cost you.

Drill as many holes as you can before assembly. Where holes must line up (like the ones for the rear axle), poke a rod or piece of shafting through when clamping up the parts.

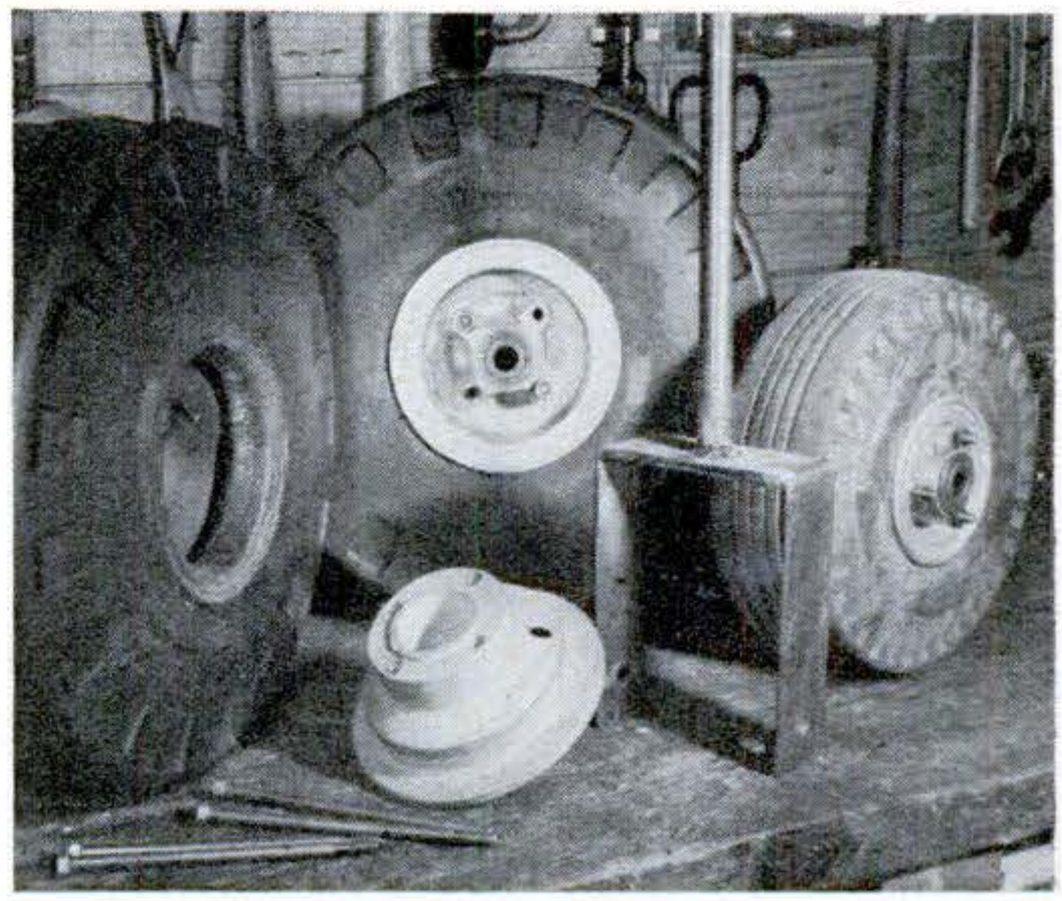
The steering gear, fork shaft and hood are supported by two square-cornered frames, each made of a single length of 1″ angle by notching and welding at the corners.

Fitting the wheels. You will have to take apart the big wheels to mount the drive sprockets. As the tires bulge when the four bolts are loosened, disassembly will be easier if you first run a long bolt



DIAGONAL BRACES are welded inside chassis members. One flange of these (and of the center countershaft mount) is notched at bottom end to clear bottom crosspiece and axle.

TIRES AND WHEELS are aircraft surplus. Air pressure of 10 or 15 lb. in tubes keeps wheels from slipping inside the casings. Each wheel consists of a pair of aluminum-alloy hubs, with ball bearings for ⅝″ shaft, held together by four long bolts. Rear wheels are 14½″ in diameter. A ½″ bolt serves as axle to hold 10″ front wheel in the steering fork.



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It Hauls a Cart

through the bearings and tighten a nut on it.

The wheel hubs have a concentric shoulder, and if you have a lathe the sprockets can be bored to a close fit on this to make them run true. Any well-equipped garage or machine shop can do this for you.

You can avoid machining by filing or sawing the sprocket to an oversize fit on the shoulder and drilling the bolt holes oversize. Mount the sprocket with spacers cut from ¼″ pipe, long enough to set the teeth out at least ⅝″ from the tire. You'll have to replace the original wheel bolts with longer ones. Leave the nuts a bit loose. Set the wheel rotating on a ⅝″ shaft. Then shift the sprocket about on the bolts, with taps of a soft hammer, until it runs perfectly true, and tighten the nuts securely. Take the time to do a good job, for an off-center sprocket will make the chain run noisily and wear rapidly.

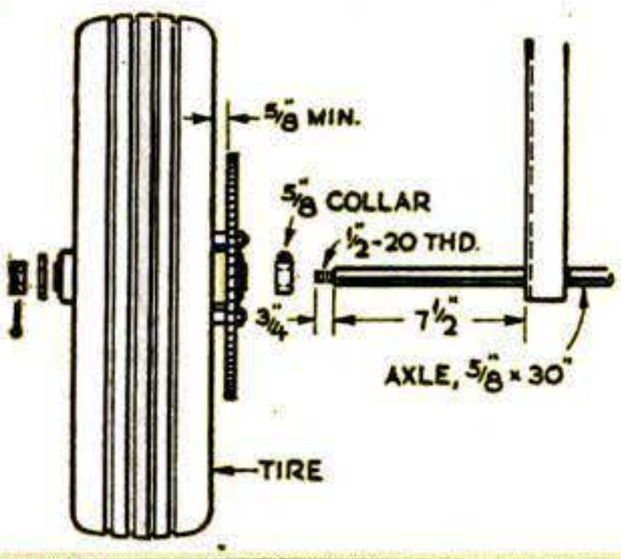
The axle should be shouldered and threaded in a lathe. After it has been welded into the frame, slip a shaft collar on each end. Slide the wheels up against the collars and put enough washers between the wheels and nut to take all slack out of the bearings. Then back off each nut one notch and cotter-pin it. It is a good idea to pack the bearings with grease beforehand and put rings of heavy felt between them and the collars or washers to keep out dirt.

The steering fork. The single front wheel is mounted in a fork bent cold from ⅛″-by-2″ iron. A second similarly bent piece is welded inside to reinforce it. Both pieces are drilled ½″ for the ¾″ fork shaft, which is shouldered to fit and welded both above and below.

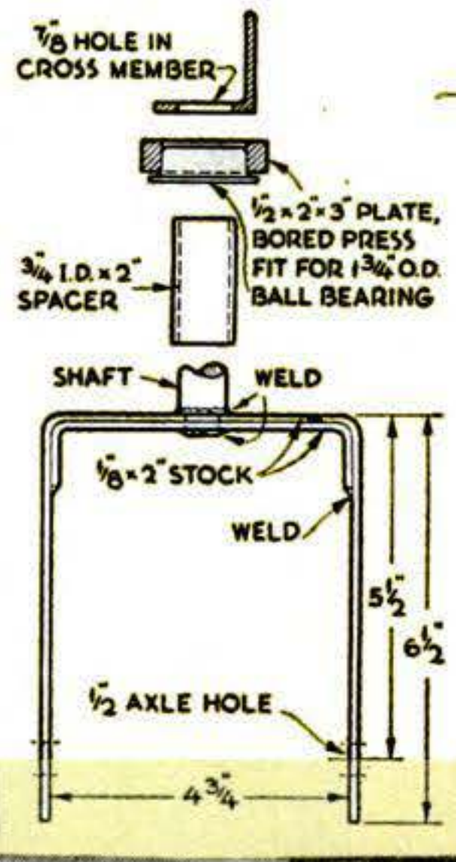
At the top, the shaft turns in a hole in the front hood frame. Below, it runs in a ball bearing recessed into a ½″ plate (I used two ¼″ thicknesses of dural). In mounting the wheel, pull up the axle nut until the bearings have neither slack nor bind.

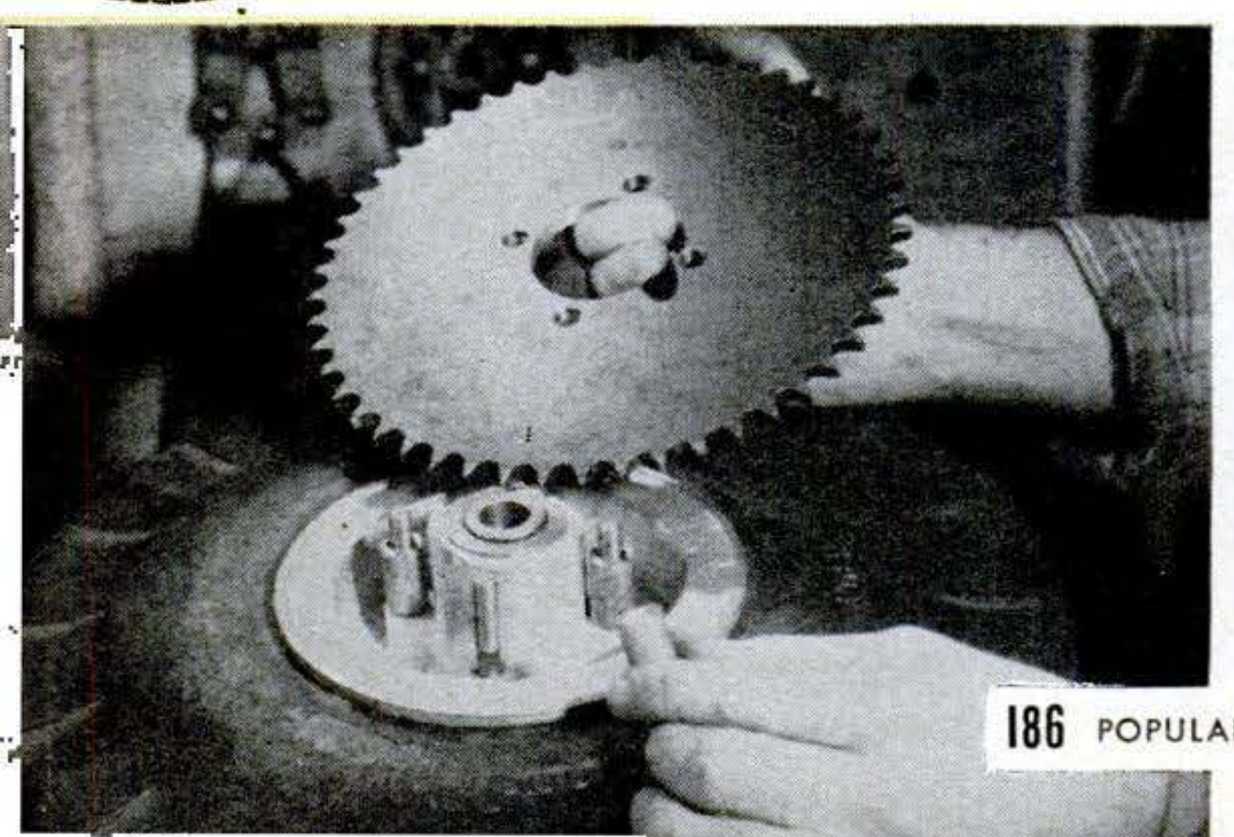
Two bevel gears from an Easy washing-machine wringer connect the steering-wheel shaft to the fork. These gears have 15 and 25 teeth, or a ratio of less than 1 to 2. This makes steering quite sensitive, and you may prefer gears that give a larger

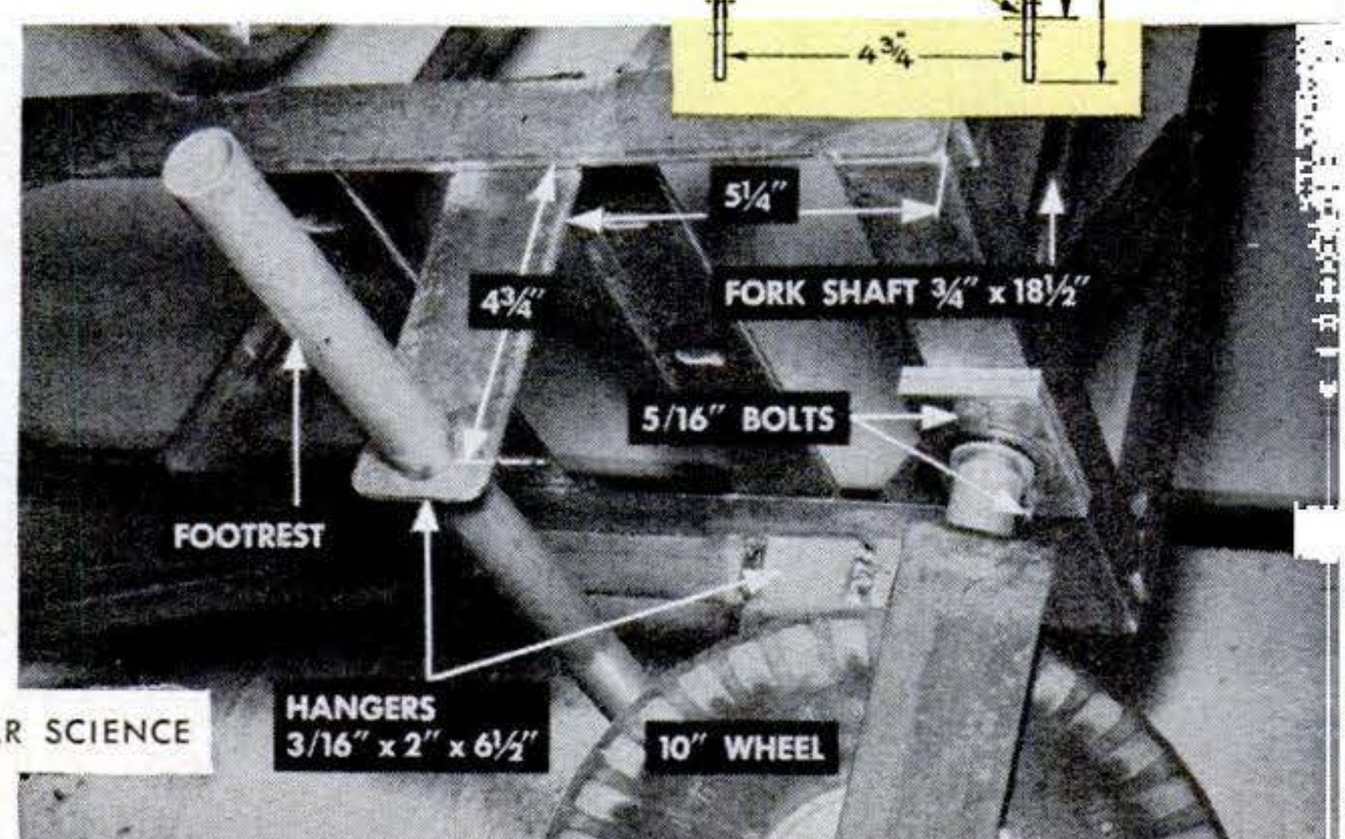
DRIVE SPROCKETS are mounted on rear wheels with ¼″-by-6″ bolts. Spacers cut from ¼″ pipe are slipped on the bolts first; they should be long enough to set sprocket ⅝″ out from side of inflated tire. The distance from sprocket face to frame should be at least ⅞″. Ends of axle must be squarely shouldered and threaded to provide for adjustment of ball bearings. To facilitate assembly, clamp hubs with a bolt through the bearings.

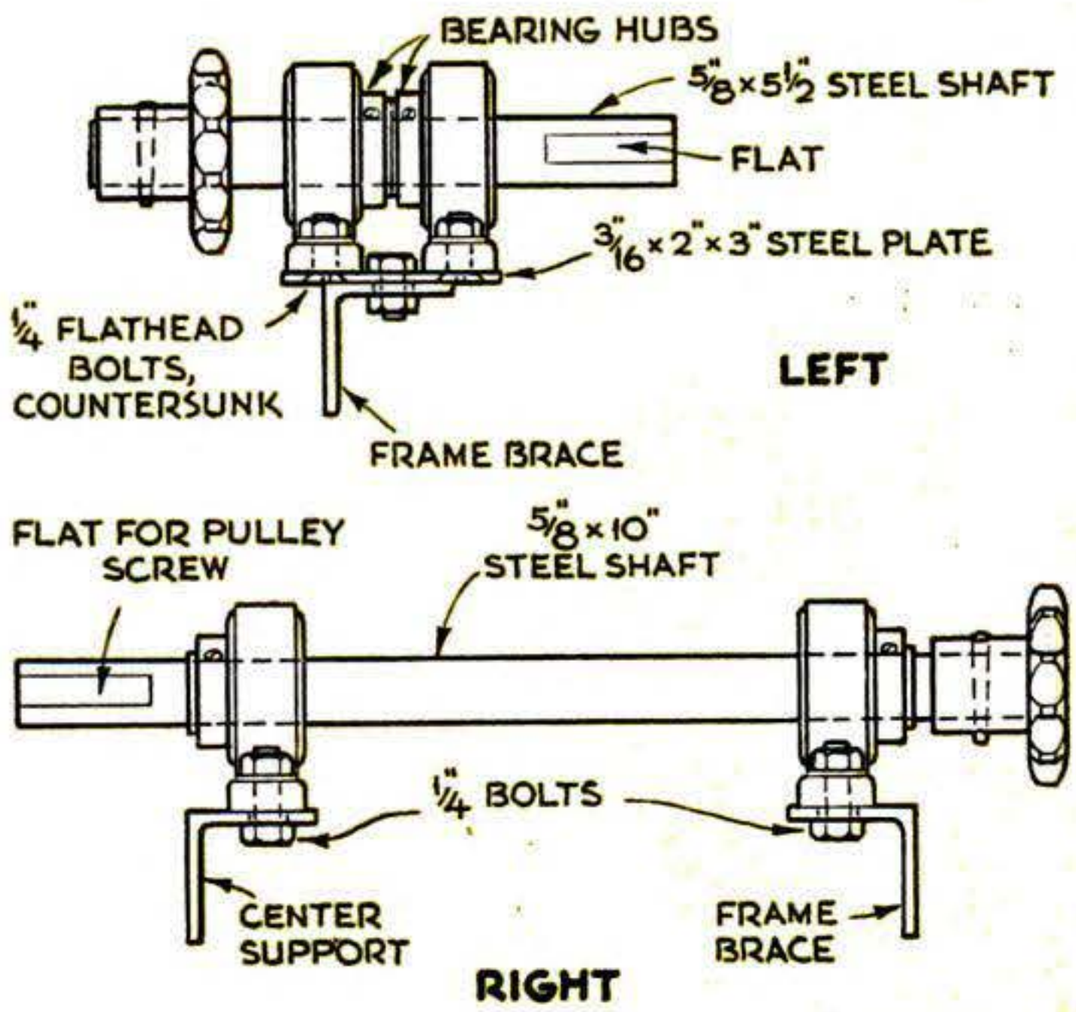


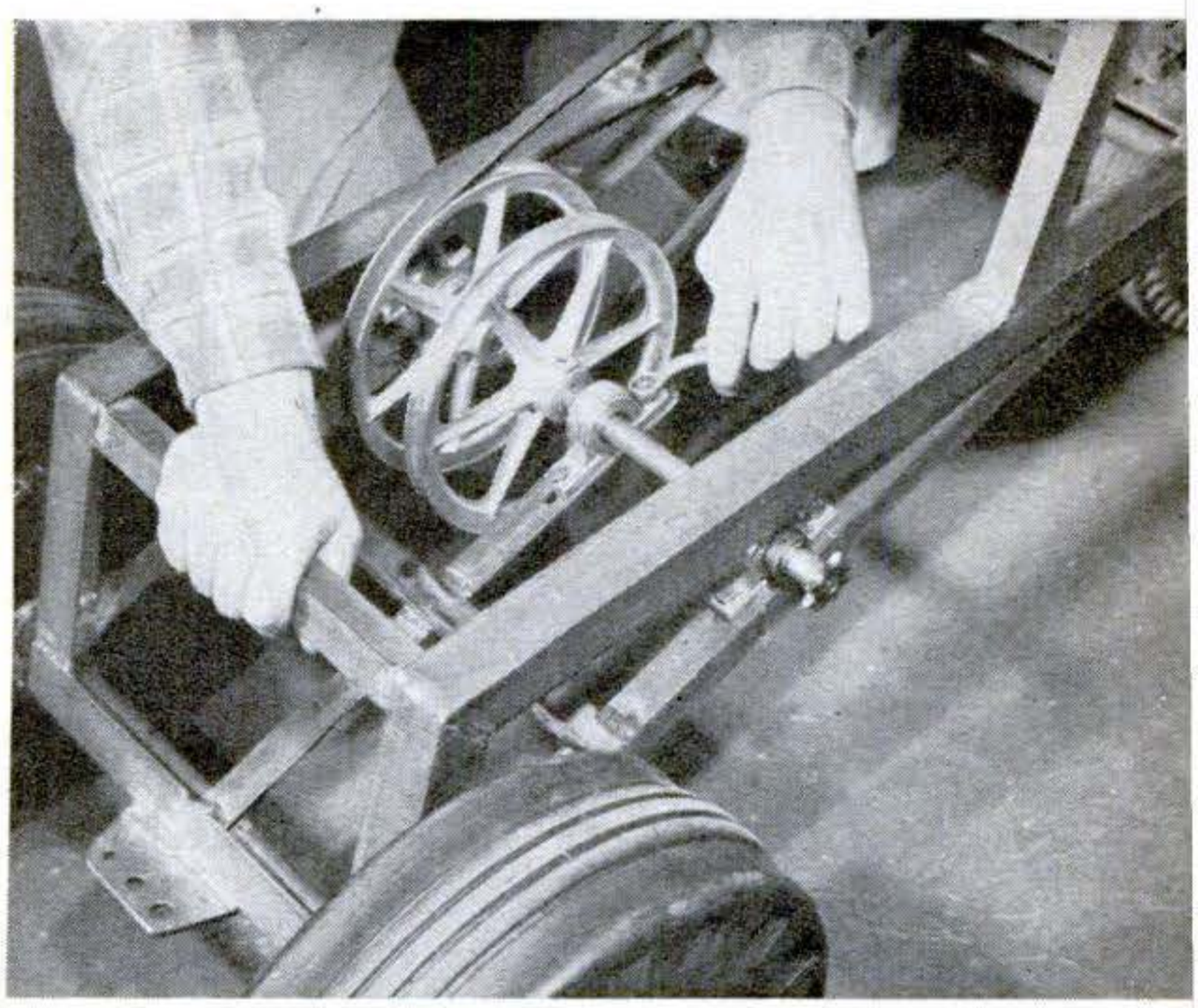
OVERSIZE HOLE, a free fit for ¾″ fork shaft, is drilled near flange corner of front frame cross-piece. A ½″ thick plate to house the ball bearing is bolted under this. The fork is bent up of ⅛″ flat stock, with an extra piece welded inside the top leg. Shaft is turned or filed to a ½″ shoulder where it enters the fork hole. Footrest hangers are welded inside the long chassis members.





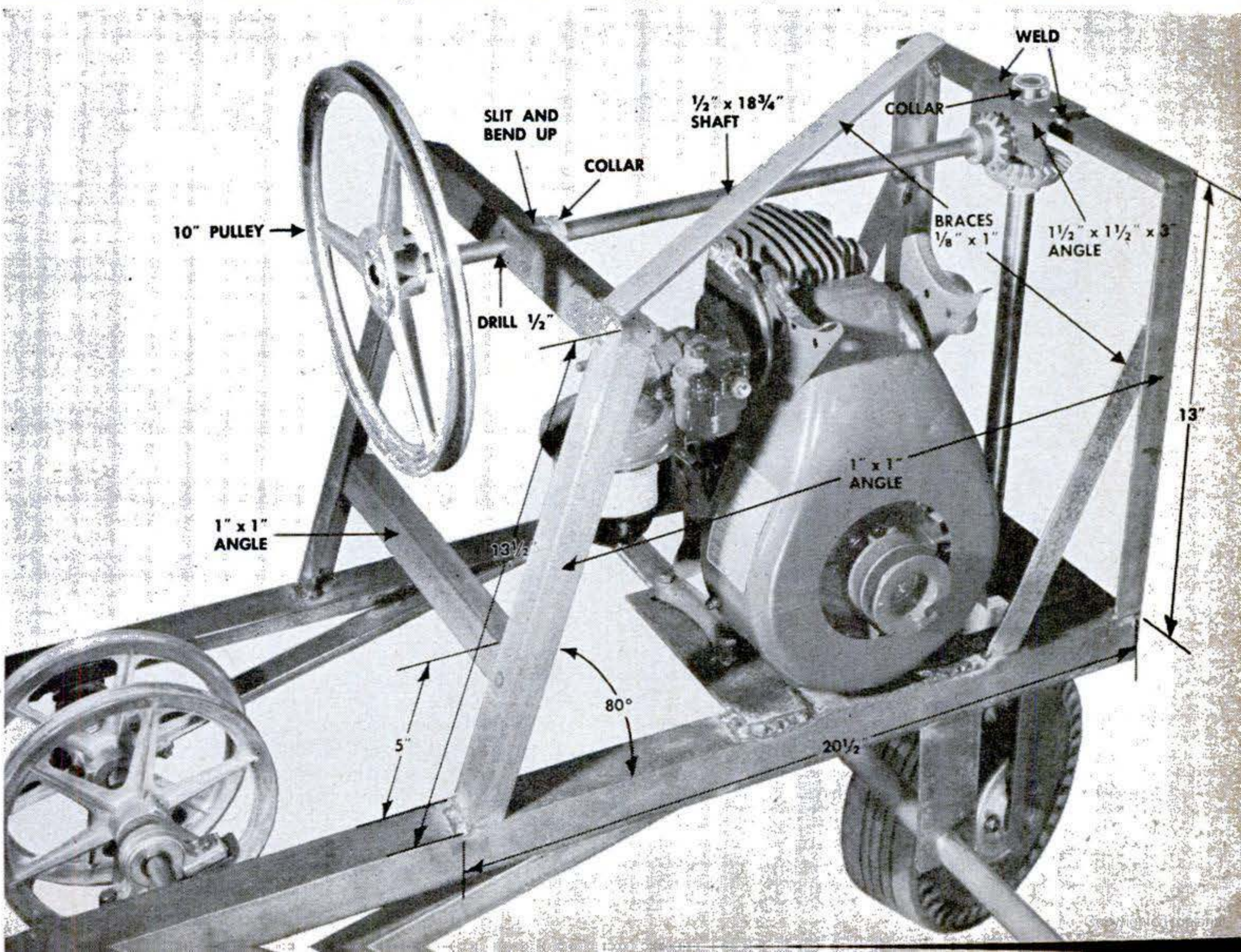


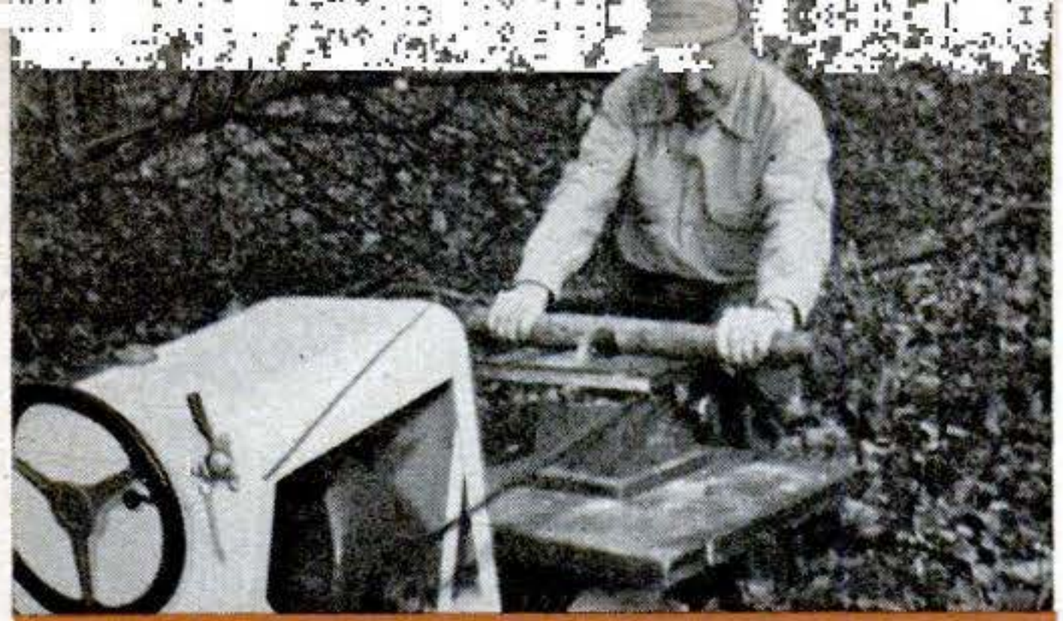




SEPARATE COUNTERSHAFTS turn in ball-bearing pillow blocks. For long shaft on right side, these are mounted on center support and frame brace. For the short countershaft on left side, both blocks are mounted on a steel plate bolted to the left-hand frame brace. All bolt holes are slotted to provide for taking up chain at least one link length. Inner races of the bearings have protruding hubs with setscrews to lock shafts against end movement. File flats on shafts to give screws a good grip. Chain sprockets are secured with No. 0 taper pins, left one hub out to keep chain near frame despite bearing overhang.

HOOD FRAMES are built up from 1" angle, notched and welded at corners. Front flange of forward frame is long enough to overlap the chassis crosspiece; other flange is notched to rest on top. Diagonal brace helps resist twist. Metal between saw cuts on top of dash frame is bent up to clear steering shaft. The gears are held with taper pins. A spacer in front of the smaller gear maintains correct tooth mesh. Steering wheel was made by cutting alternate spokes out of a 10" pulley; use a cast-iron, not a die-cast pulley, for this. A piece of rubber tubing in the groove is wrapped with plastic tape to finish the rim.



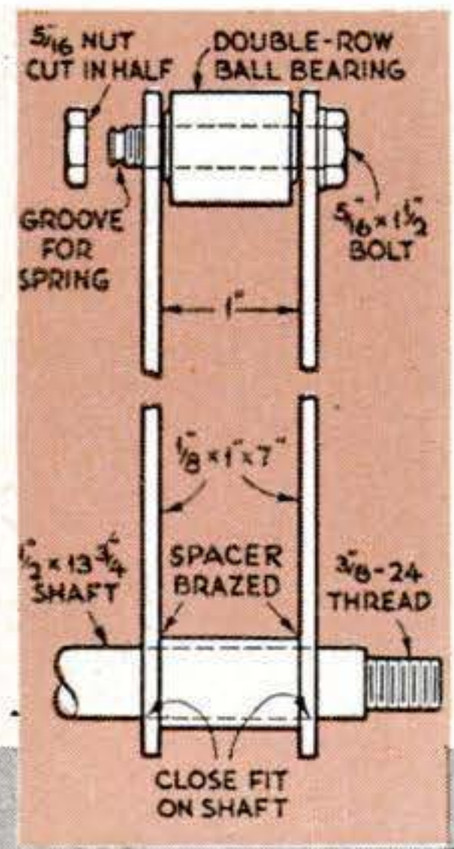


It Runs a Power Saw

ratio; 1 to 4 would be quite fast enough.

Mounting the countershafts. These run in ball-bearing pillow blocks, which are easy to align and come sealed and lubricated for life. Slotted mounting holes in the chassis members allow for adjusting chain tension.

The eight-tooth sprockets come only with a ½″ hole, so if ⅝″ countershafts are used they will have to be shouldered in a lathe to fit. An alternative is to use ½″ countershafts, bearings and pulleys.



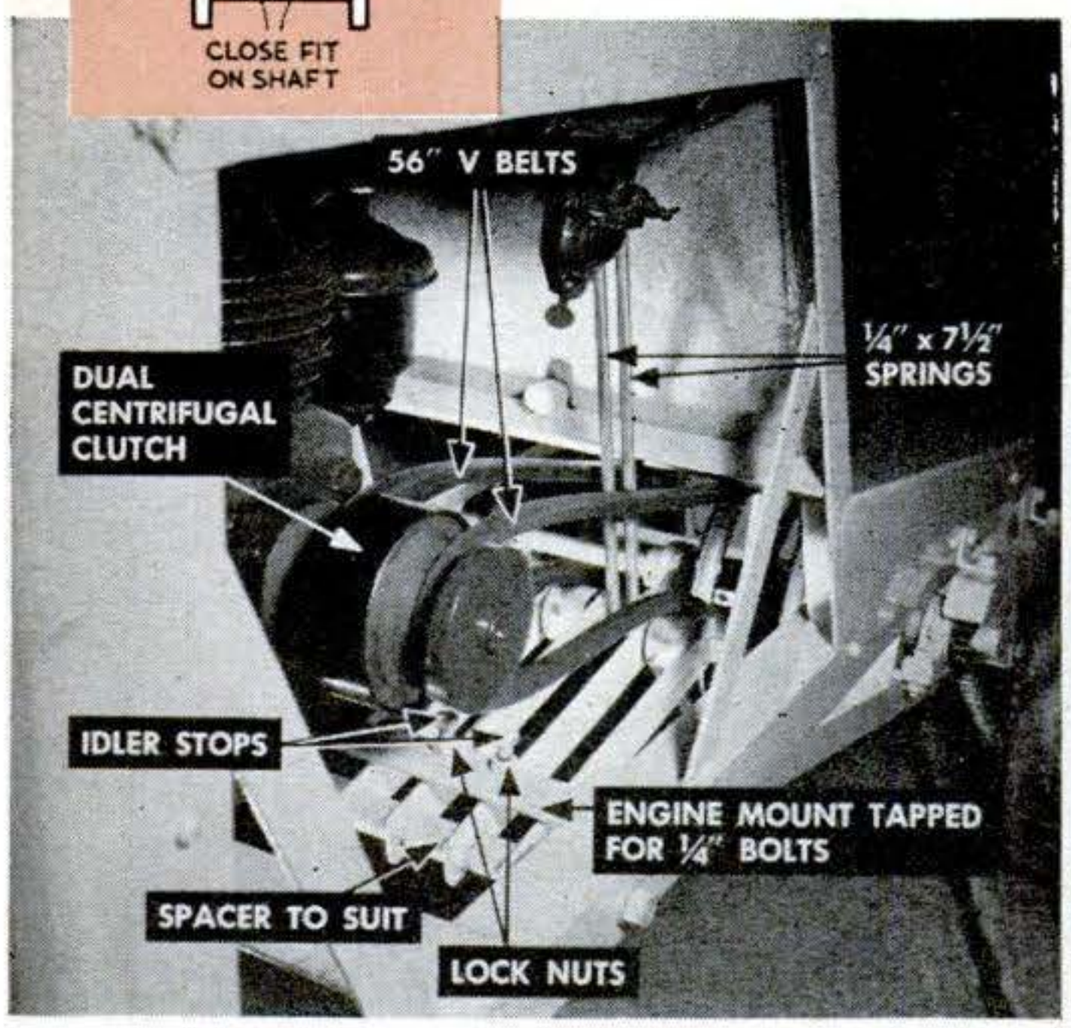
Align countershaft sprockets carefully with the wheel sprockets. If these are well centered, the chains need little slack. But they should not be tight. With the top of the chain taut, the bottom should have ¾″ up-and-down slack.

Installing the engine. Slotted holes in the frame mounts allow for tensioning of the V belts. Align the 8″ countershaft pulleys with the fixed cones of the clutch. Adjust the engine fore and aft so that the belts climb just to the outside of the fixed flanges when the sliding ones are at their closest.

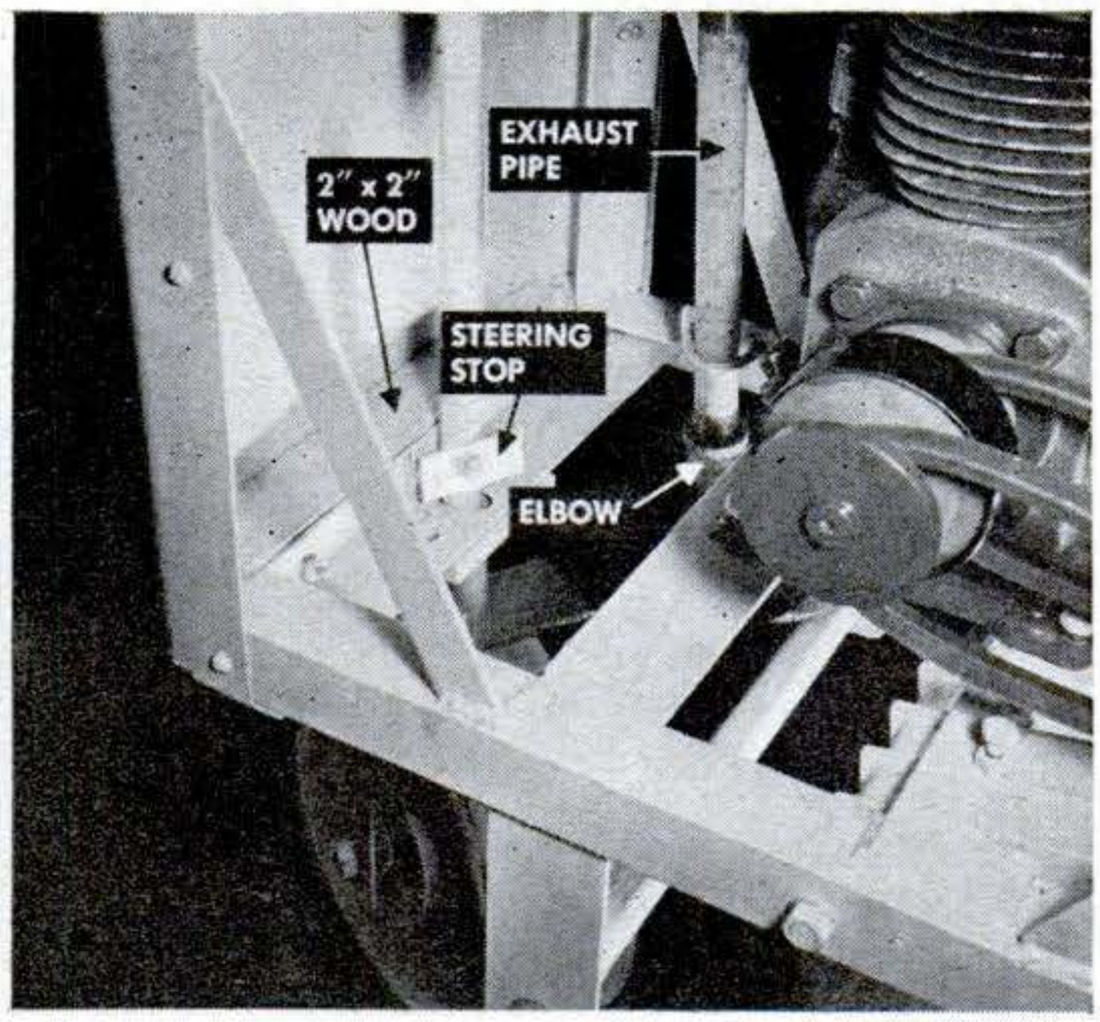
The idlers pivot on a shaft that runs across the frame below one engine mount. They are pulled upward against the outside of the belts by long springs attached to the dash frame. The rollers are ball bearings and must be about ⅞″ wide to keep the belts from sliding off when they shift sidewise because of the clutch action. You will find that the tension of the idler springs affects the ratio shift; if the clutch goes into "high" as soon as the engine speeds up slightly, idler tension should be increased.

With the engine idling, the belts should be slack, so the idler brackets are fitted with stop screws. Adjust these so that the rollers put no tension on the belt when the clutch cones are wide open.

The gas tank was removed from the engine and mounted under the hood of the tractor shown. A new lever was made for the governor spring, with a downward ex-



SPRING-TENSIONED IDLERS keep belts taut as automatic clutch shifts. Stops limit idler movement to let belts go slack as engine runs slow. Idler shaft, centered below front of rear motor mount, enters ½″ hole in right of frame. Left end shown is shouldered for ⅜″ hole and threaded for a nut. To use engine for sawing wood and the like, centrifugal clutch must be pulled off shaft. Running it with belts off may cause internal damage.



FRONT-WHEEL TURN must be limited because centrifugal clutch cannot stop inner wheel dead. Stop is a 1″-by-3″ piece of flat iron bolted to fork shaft, which is tapped for the bolt. Swing of 45° each way gives good maneuverability. Exhaust pipe is clamped to frame with a U bolt. Sheet-metal front is screwed to shaped wooden blocks bolted to crosspieces. Block on top, made from a two-by-four, is also shaped for 2″ radius of hood.

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tension having a hole for the throttle cable. The dashboard throttle is one made for power mowers and is connected to the governor lever. An auto-choke cable was cut short for the choke control, and a steel wire run to the stop lever on the engine.

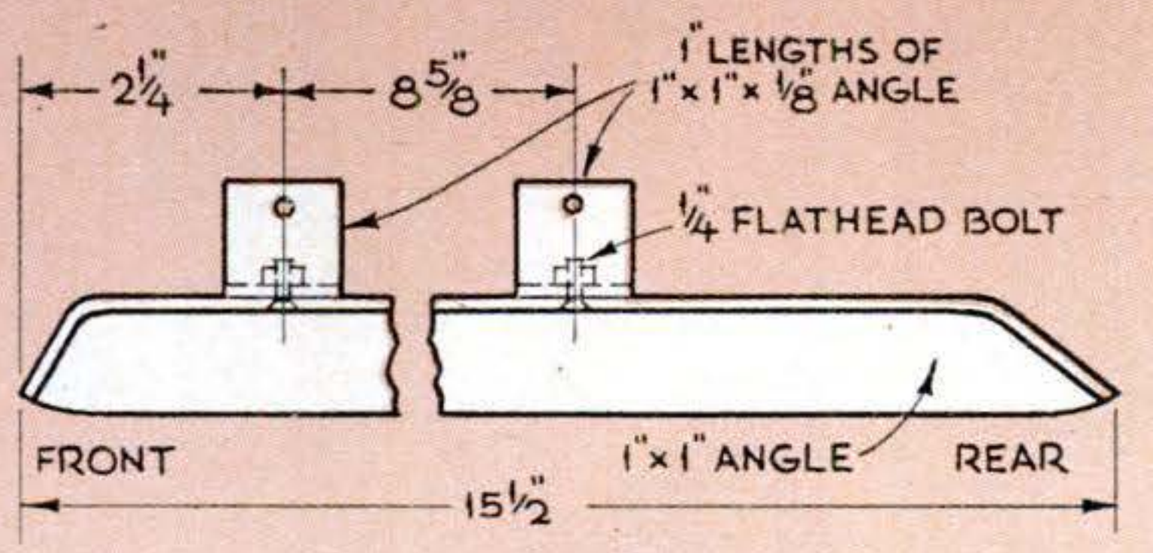
The seat. A comfortable motorcycle saddle provides springing and soaks up a lot of engine vibration. It is mounted on a 3′ length of ⅜″ steel rod welded to the crosspiece of the dash frame and to the top rear member of the chassis. The saddle can be adjusted fore and aft on this.

Building the body. A panel of composition board is bolted to the rear of the chassis. The deck and sidepieces are bent from one piece of light sheet iron. A long slot in the back will let you worry this piece around and under the tractor's seat bar.

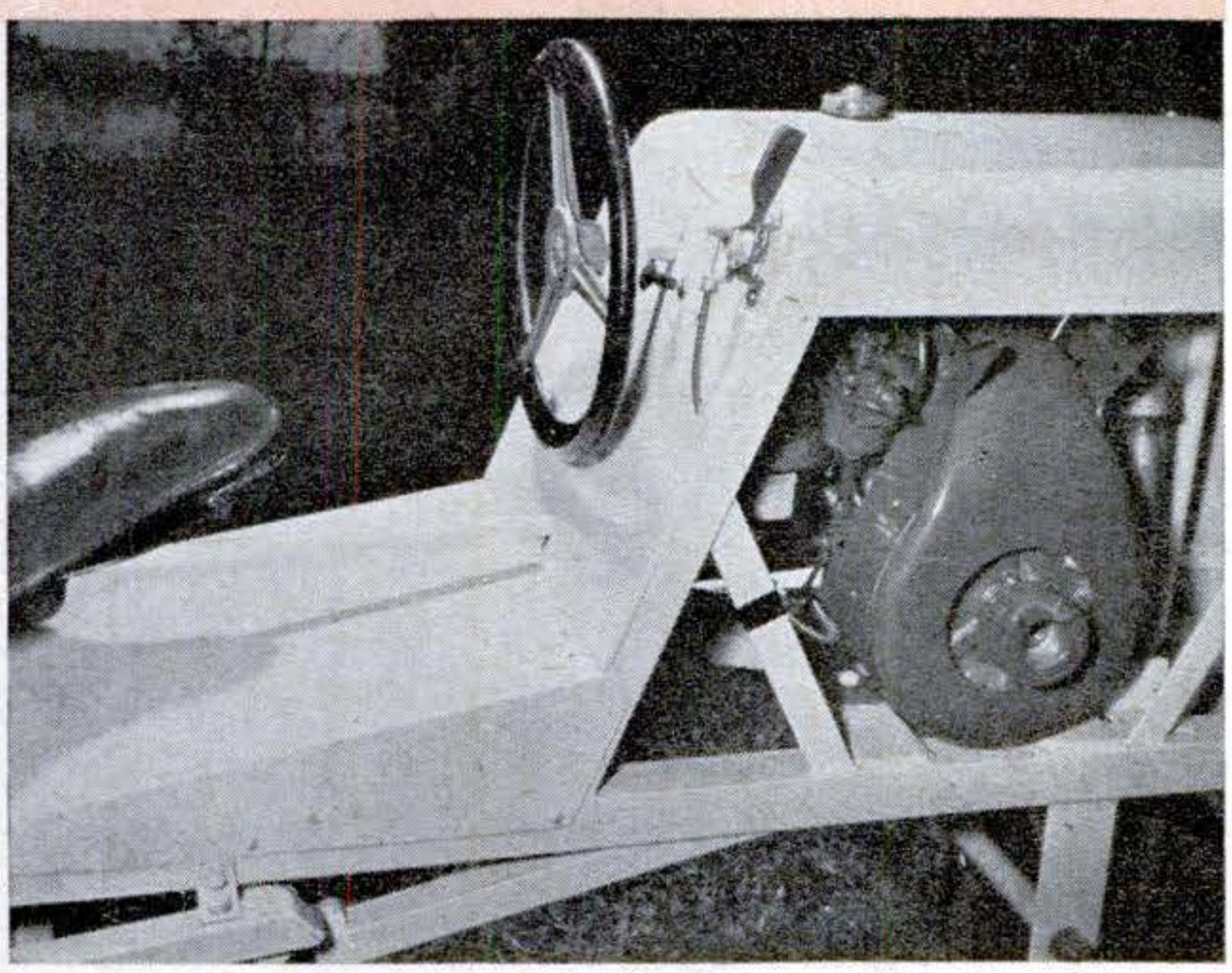
It Pulls a Spreader

Pieces of wood rounded to shape are formers for the sheet-metal radiator and hood. I bent the hood metal over a rolling pin to a 2″ radius, and rolled the straight edges over a piece of ⅛″ iron wire.

Clean all metal parts well; then apply metal primer and two coats of enamel. END



CHAIN GUARD
(2 REQ., 1 RIGHT, 1 LEFT)



DASH FRAME also has shaped block bolted to it. Dashboard is 3/16″ composition board. Deck and sides under the saddle bar are one piece of sheet metal, with narrow flange bent down at rear end to overlap rear panel, and a similar flange at front to slip under the dashboard. Chain guards must be strong enough not to bend and foul chains if stepped on. Make them of angle iron and mount with short brackets cut from the same stock.

LIST OF MATERIALS

SOURCES from which many of the parts specified were obtained are noted below. Where source is not given, parts can be bought from local suppliers or mail-order houses.

ANGLE IRON: 11′ of ⅛″ x 1½″ x 1½″; 15′ of ⅛″ x 1″ x 1″.

STRAP IRON: 10′ of ⅛″ x 1″; 4′ of ⅛″ x 2″; 2½′ of 3/16″ x 2″.

COLD-ROLLED STEEL ROD: 3′ of ½″ dia.; 6′ of ⅝″ dia.; 18½″ of ¾″ dia.

PIPE: 10″ of ¼″; 13″ of ½″; 3″ of ¾″ i.d. tubing; two ½″ elbows (one 90°, one 45°).

WHEELS: Two 14½″ channel-tread tires with tubes, wheels and bearings for ⅝″ axle. One 10″ channel-tread tire with tube, wheel and bearings for ½″ shaft. (Midget Motors Supply, Athens, Ohio.)

ENGINE: Lauson RSC 1½ hp., four-cycle engine with governor, air cleaner, gas tank.

CLUTCH: Dual centrifugal clutch for ⅝″ shaft and ½″ V belts. (V-Plex Clutch Division, Hagerstown, Ind.)

PULLEYS: Two 8″ dia. for ⅝″ shaft and ½″ V belts. One 10″ dia., cast iron, for ½″ shaft.

DRIVE: Two ½″ V belts, 56″ long. Three ⅝″ shaft collars. Three ½″ shaft collars. 7′ of No. 41 roller chain and two connectors*. Two 8-tooth sprockets, Diamond B-308*. Two 50-tooth sprockets, Diamond A-350*. (*R. M. Barwise, 75 Varick St., NYC.)

BEARINGS: Four ball-bearing pillow blocks for ⅝″ shaft No. 6-500-6. (Master Mechanic Mfg. Co., Burlington, Wis.) One unground flanged ball bearing for ¾″ shaft, 1¾″ o.d., Nice No. 5891. Two high-speed, double-row ball bearings ⅞″ wide, Norma DF5. (Columbo Trading Co., 383 Canal St., NYC.)

MISCELLANEOUS: Power-mower throttle, auto choke cable, stop wire; bevel gears, 1:2 ratio or larger; heavy-duty motorcycle saddle (Midget Motors Supply); ½″ x 2″ x 3″ fork-bearing plate (dural or steel); 2 sq. ft. 3/16″ hard composition board; 7 sq. ft. 24-ga. sheet iron; two ¼″ x 7½″ idler springs; eight ¼″ x 6″ bolts and nuts; 25″ of ⅞″ o.d. conduit; 4′ of 2-by-4 wood; two crutch tips; nuts, bolts, lock washers, wood screws, taper pins, cotter pins, 33″ rubber tubing, tape, metal primer and auto enamel.

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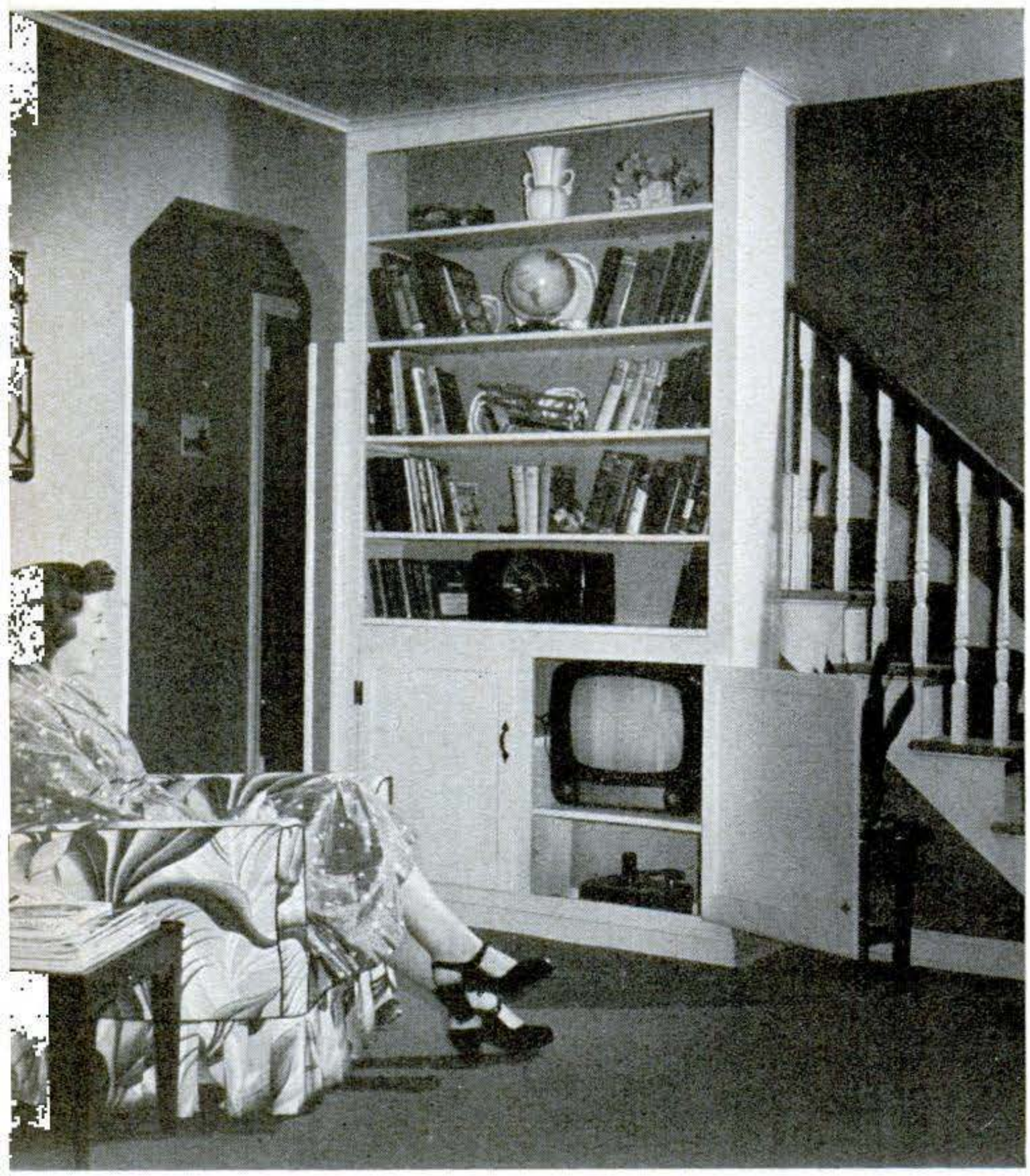
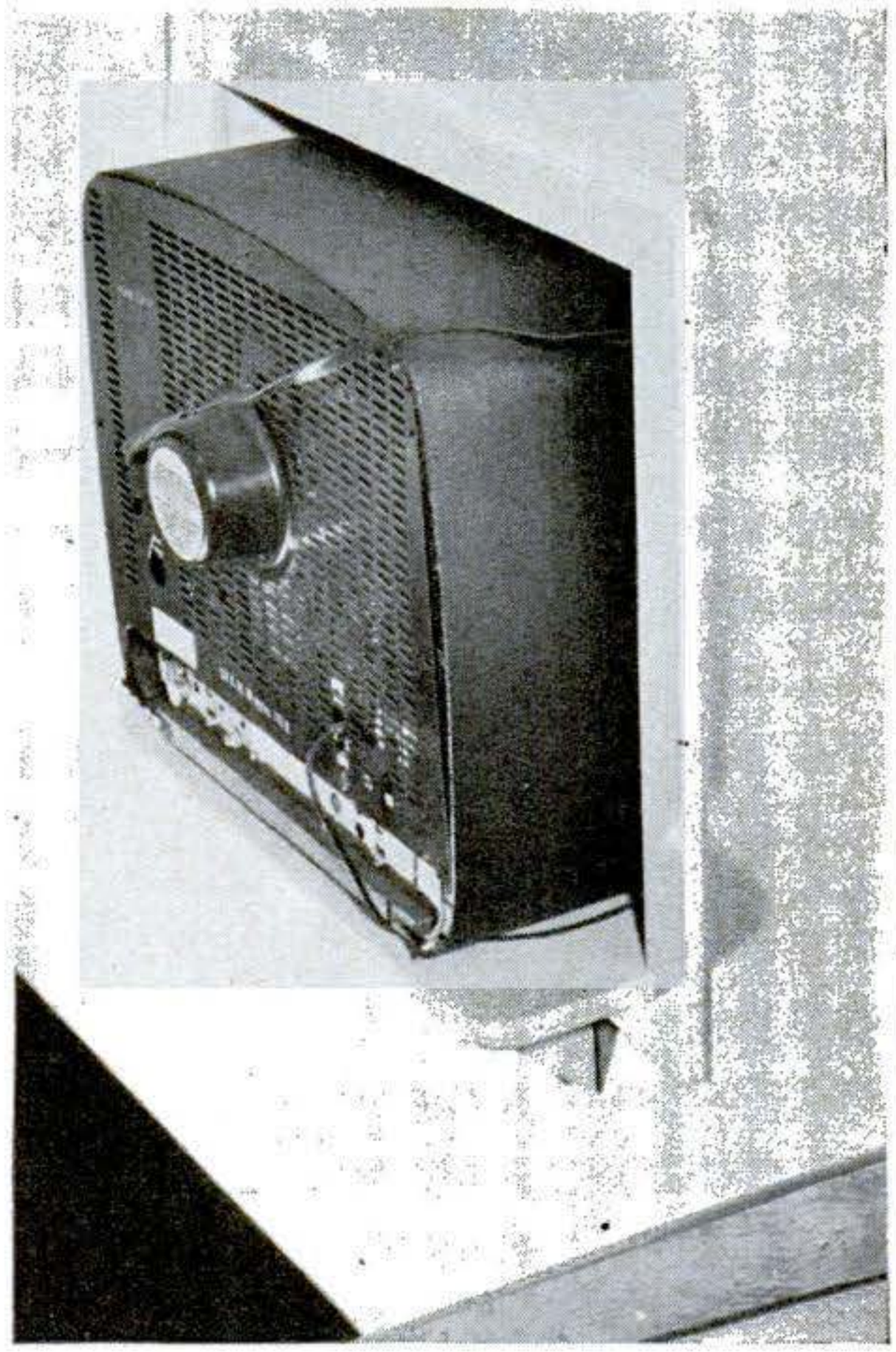
A Hole in the Wall Hides



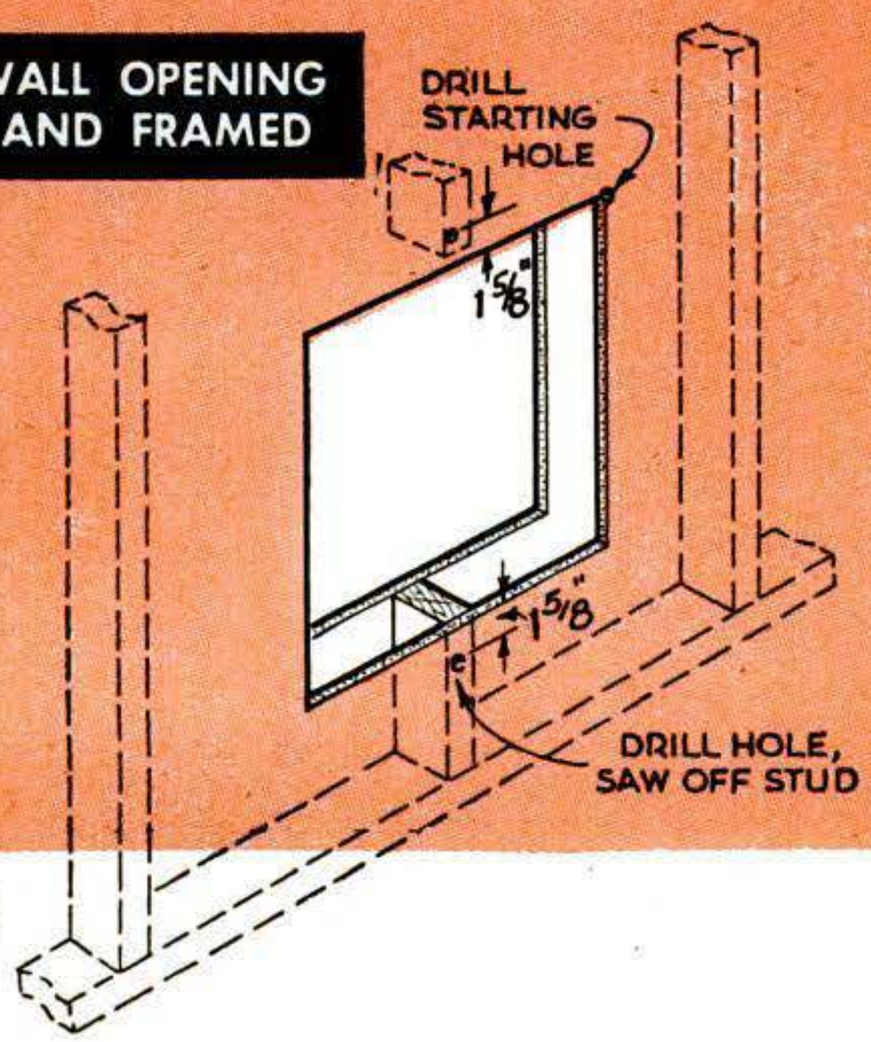


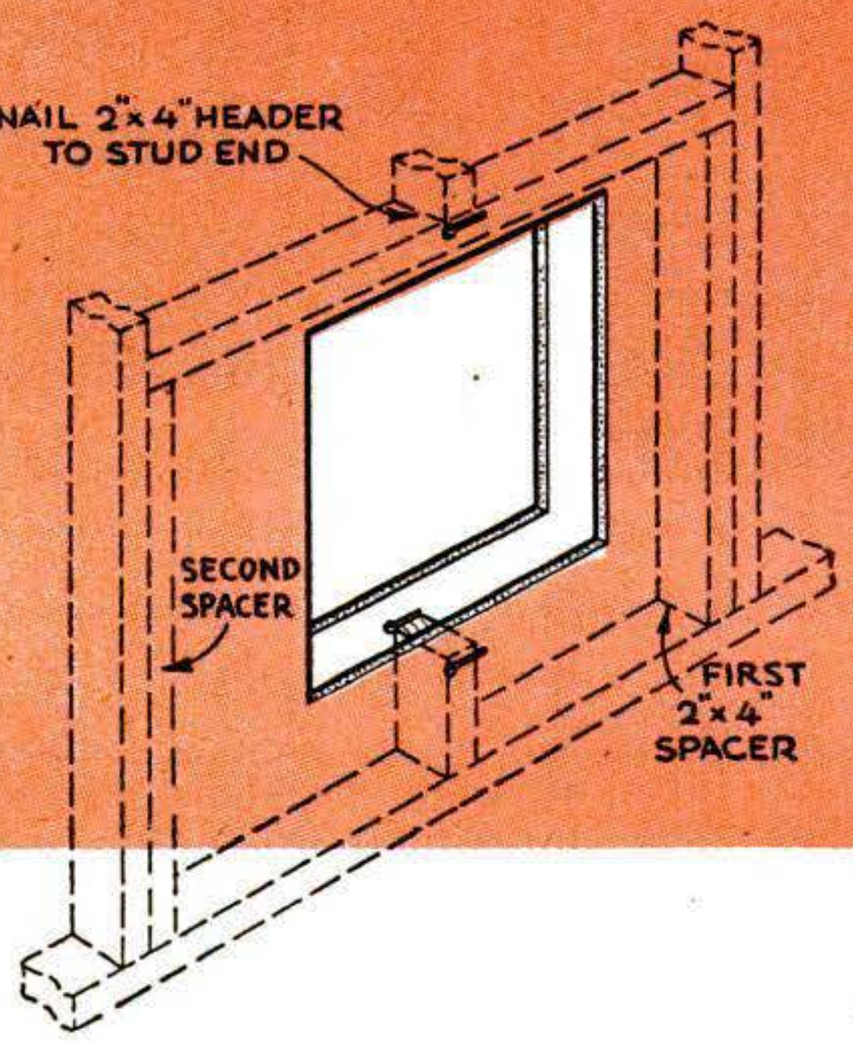
TV SET, viewed from living room at left, protrudes through wall into cellar stairway (above), saving space. Exposing back also provides good ventilation, easy access.

DRILL STARTING HOLE at corner, insert keyhole saw and cut through stud (you may hit two) and both wall faces at same time. Ends of cut stud are then trimmed back 1⅝″ (the thickness of a two-by-four) to take frame.

TWO-BY-FOUR SPACER is nailed to adjacent stud on one side of opening, and header is shoehorned in to rest on top of spacer. Second spacer is nailed to stud on opposite side of opening to hold other end of header.

HOW WALL OPENING IS CUT AND FRAMED





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My TV Set

An easily framed opening lets a bulky set show only its face inside a room. Here's how you can build the same thing.

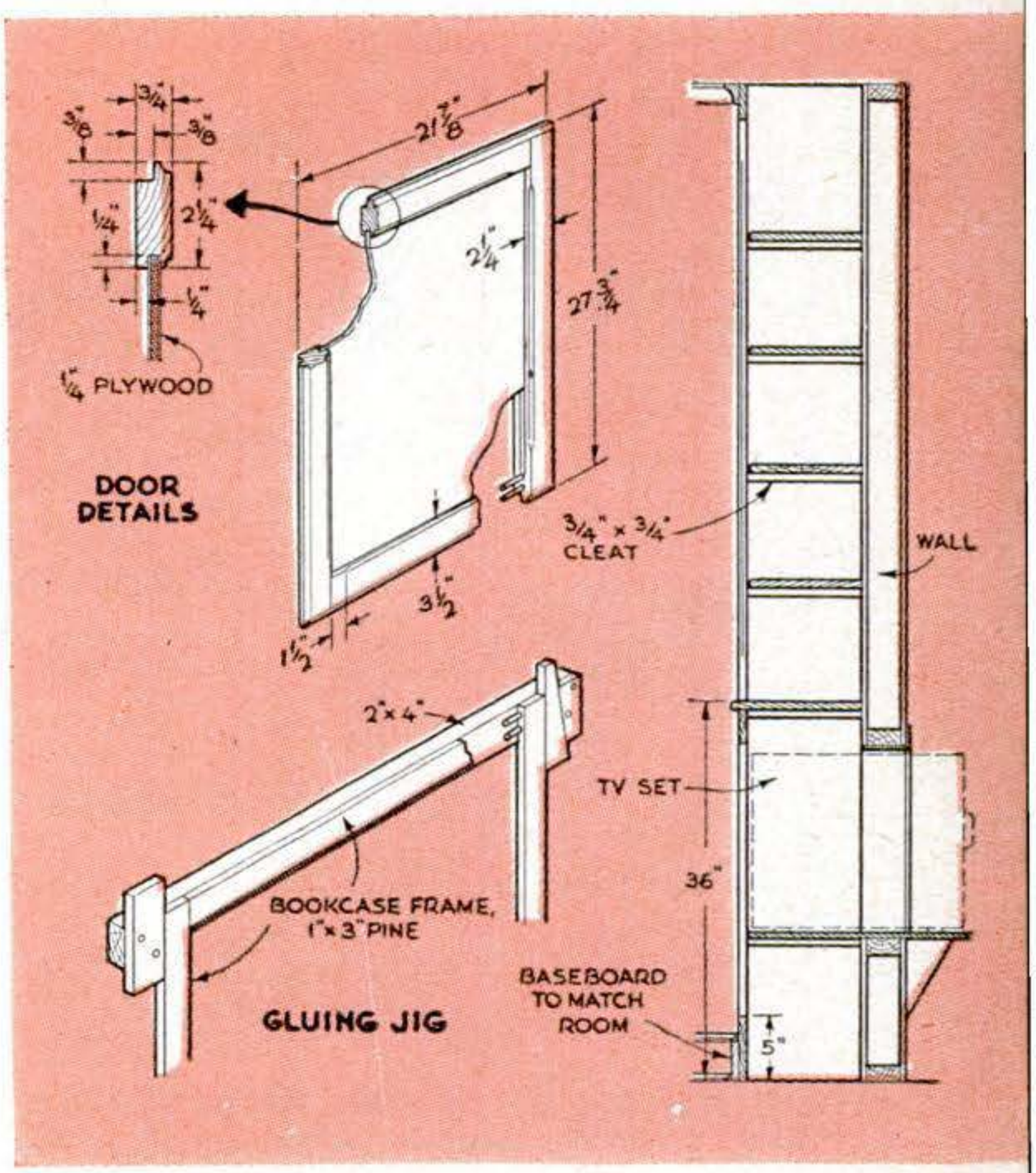
By John N. Michel

I WANTED to build my TV set into a bookcase, but books are only 5″ to 8″ deep and my set was nearly 24″ deep. How to fit in a bulky TV set stumped me until I hit on this idea. By backing the bookcase up against the cellar stairwell, I was able to let the back half of the set do a disappearing act through the wall, where it wastes no space and gets in no one's way.

The framing for the wall opening isn't hard to make and can be done anywhere that the set won't show—against a closet, utility room, kitchen pantry, even a wall that simply has another bookcase or cabinet on the other side to conceal the set.

For the bookcase, I used 1″-by-12″ pine boards for the sidepieces, nailed to the wall. Nailed to these is a front frame made of 1″-by-3″ strips, doweled and glued at the corners, with a crosspiece at the point that divides the lower cabinet from the shelves above. The top and bottom of the bookcase are trimmed with molding to match that in the rest of the room.

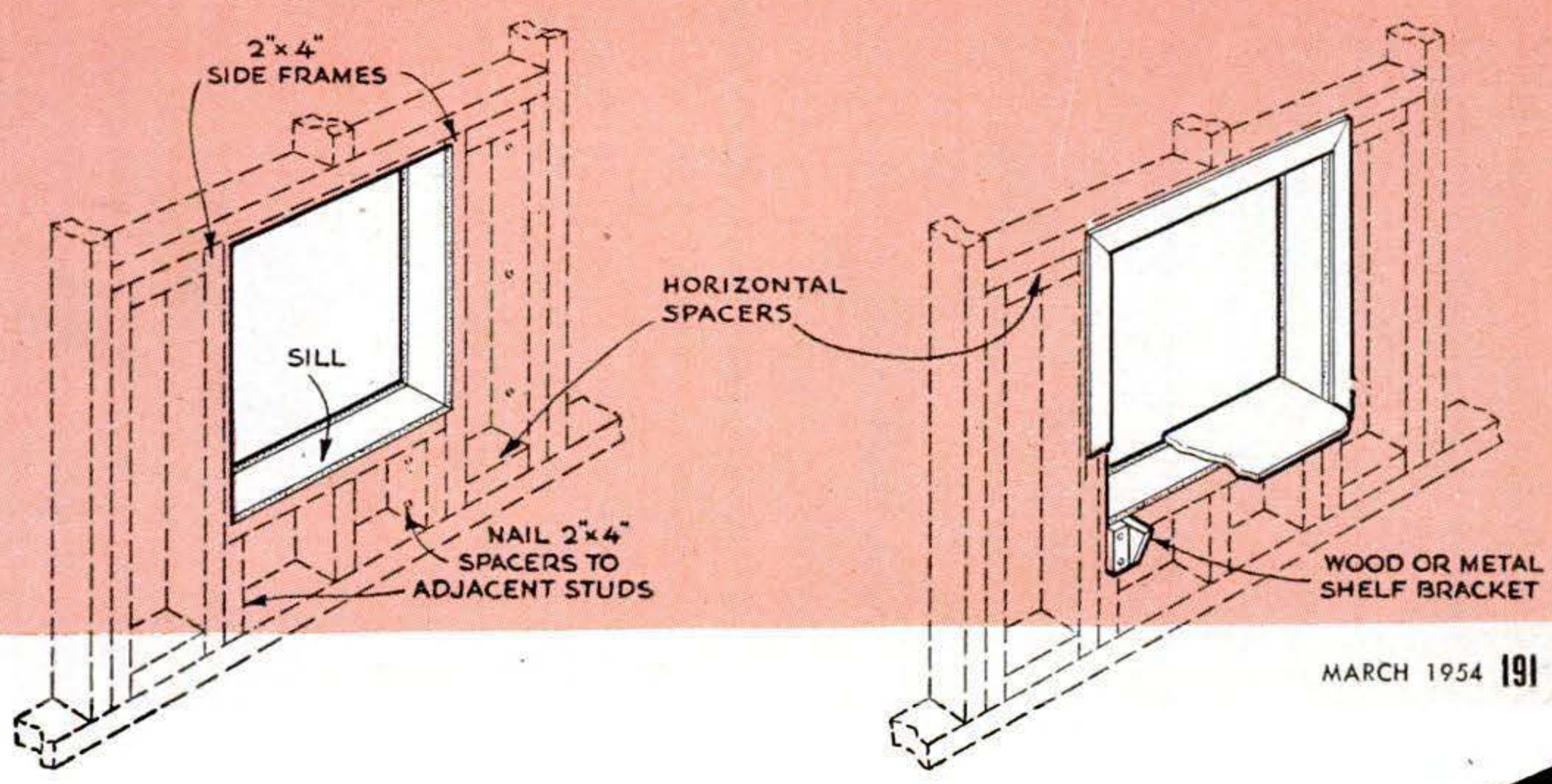
Finished off with one coat of flat white and two coats of white enamel, the result is a fine home entertainment center that takes up little space, yet houses everything needed for hours of leisure enjoyment.



SIDES OF BOOKCASE (right, above) make use of stock, inexpensive 1″-by-12″ boards, but dimensions can be varied as desired. Jig for gluing front frame can be made with two-by-fours and wedges (lower left, above). Doors can be ¼″ plywood panels set into grooved frames (top left) or simply plywood panels with decorative molding nailed at edges.

SIDE FRAMES are nailed against horizontal spacers nailed to floor and underside of header on both sides of opening. Two short vertical spacers are then nailed to side frames at bottom and two-by-four sill nailed on top.

OPENING IS TRIMMED with decorative molding, wide enough to cover saw holes made in wall. Short shelf, deep enough to take set's overhang, is nailed to sill and brackets. Opening on bookcase side is also trimmed.



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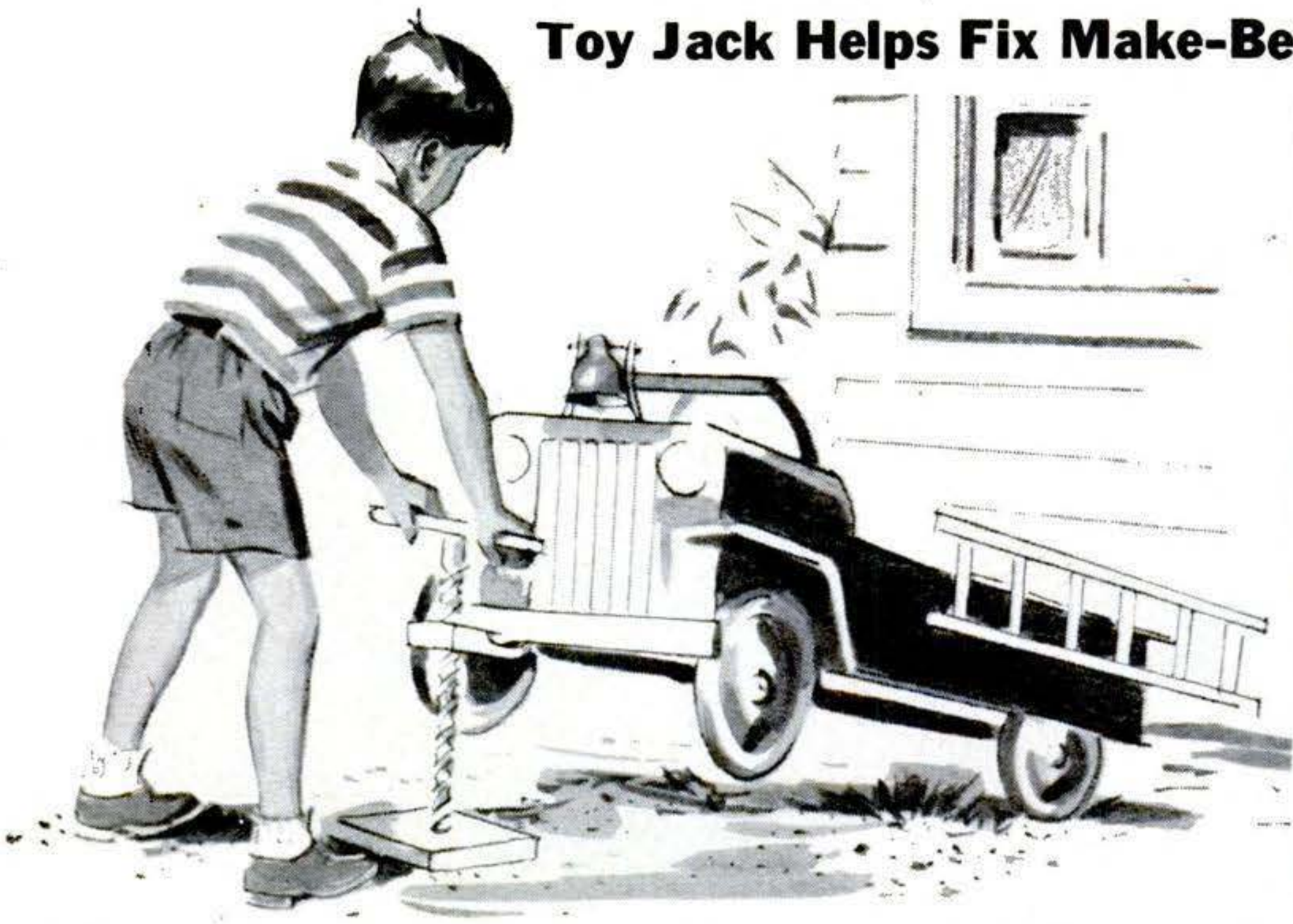
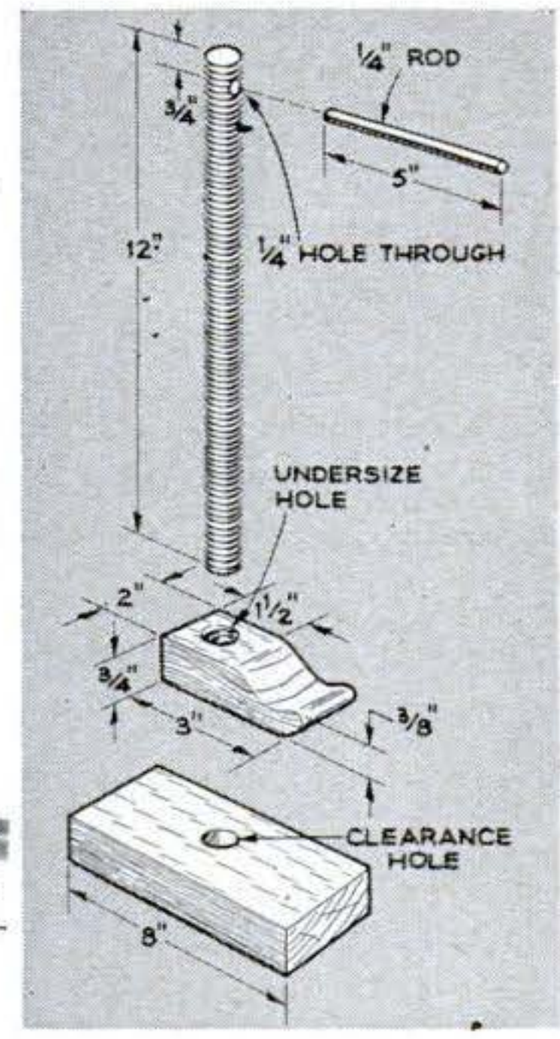
Toy Jack Helps Fix Make-Believe Flats

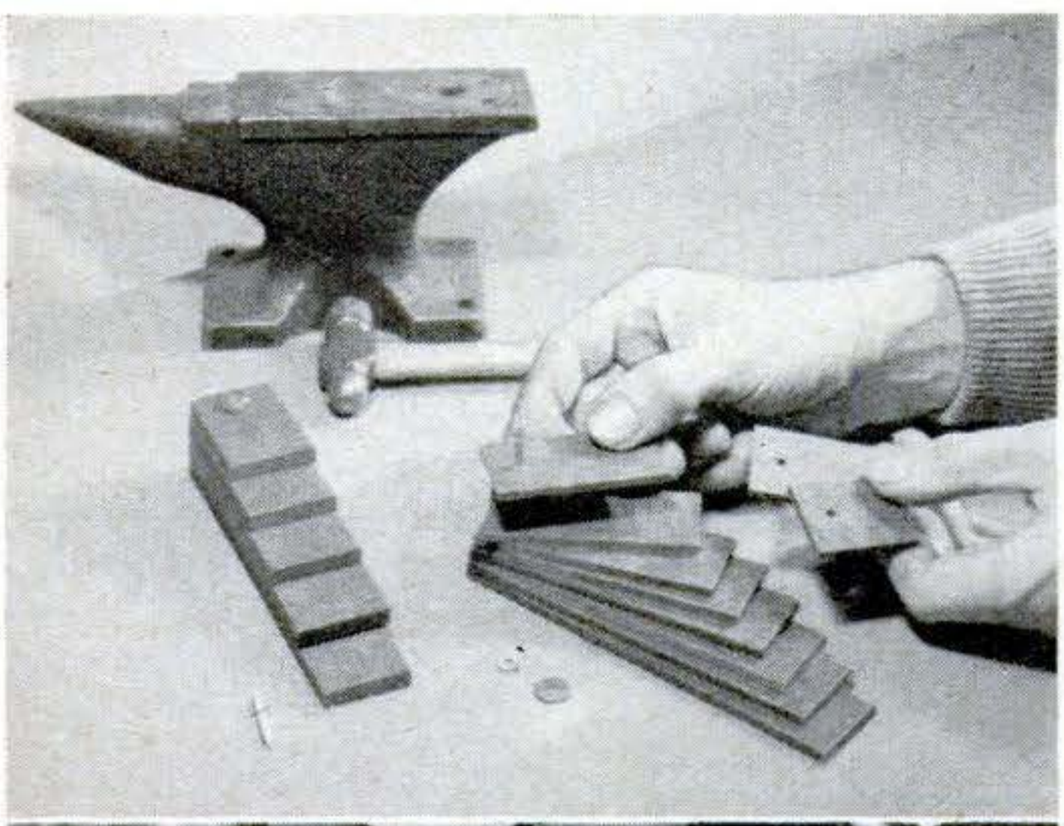




YOUR youngster will have a fine time with this toy jack, fixing imaginary blowouts on his coaster wagon or pedal car.

A piece of threaded rod, sold in 3′ lengths at hardware stores, is the backbone of the jack. Cut off 12″ and force it to cut its own threads in an undersize hole in the hardwood lifting arm. Drill a ¼″ transverse hole, ¼″ from the top, for the T handle and support the assembly on a piece of two-by-four bored part way through to clear the threads. Twisting the T handle causes the lifting arm to rise on the threaded rod.—*A. V. Malone, Los Angeles.*

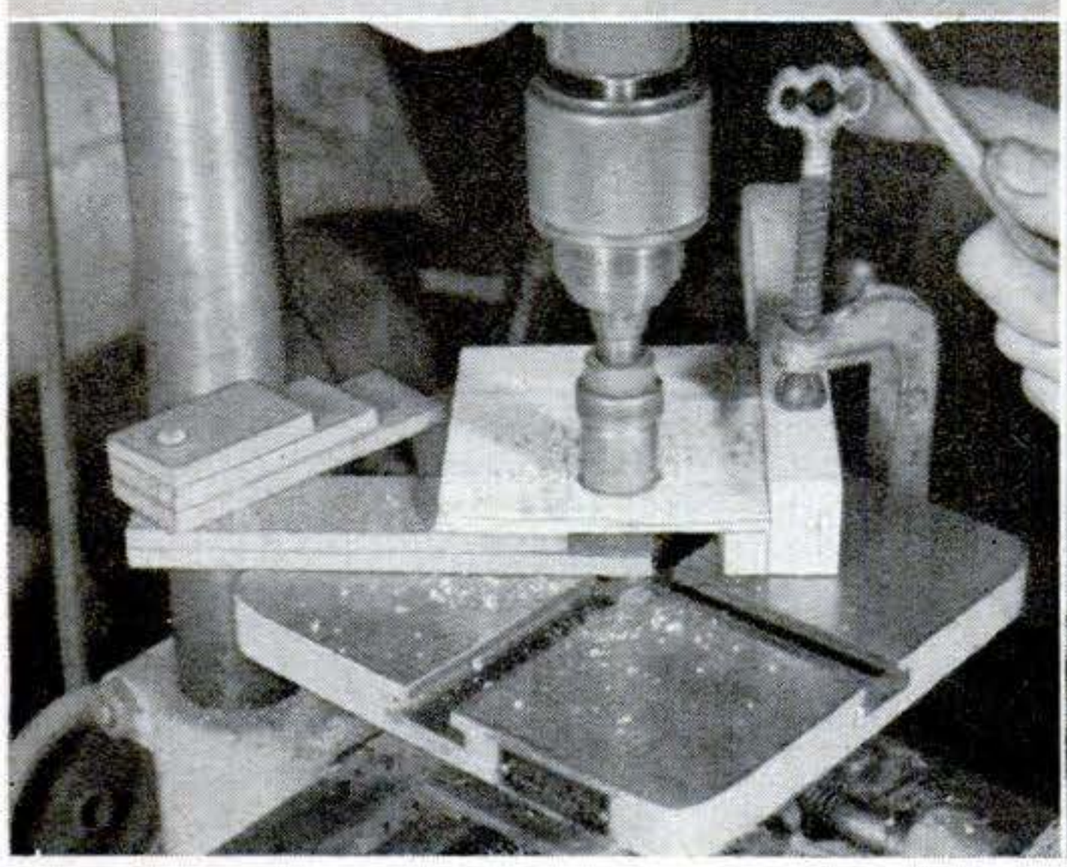
Shim Books Serve as Adjustable Thickness Blocks in Shop

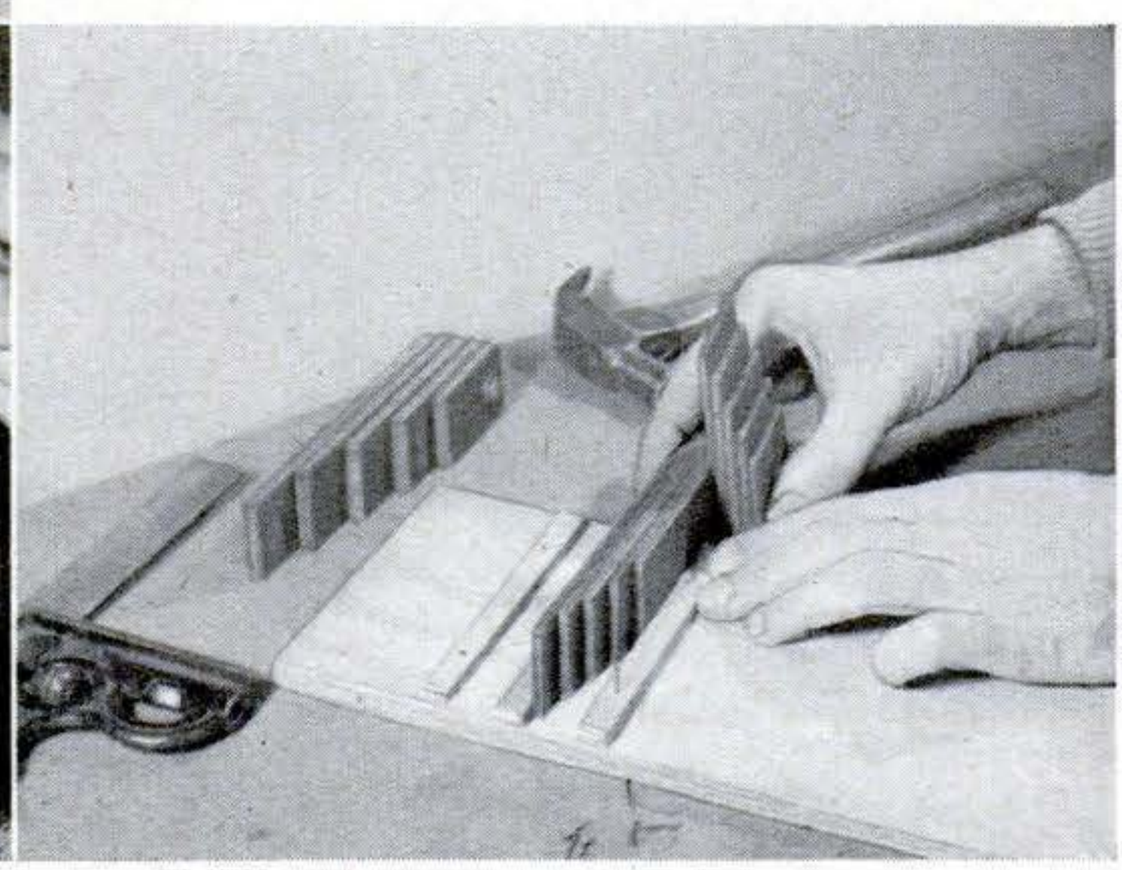


STRIPS of hardboard about 1¼″ wide, cut and stacked like steps and pivoted on one end, can serve many purposes in a shop.

Several strips can be combined as a shim or block for spacing out cleats (below, right), leveling work in a drill press (below, left) or wedging work together when gluing.

Make several sets, from ⅛″, 3/16″ and ¼″ stock—so that all or part of each book adds up to multiples of those thicknesses. A nail cut and peened over a washer serves as the pivot.—*Walter E. Burton, Akron, Ohio.*





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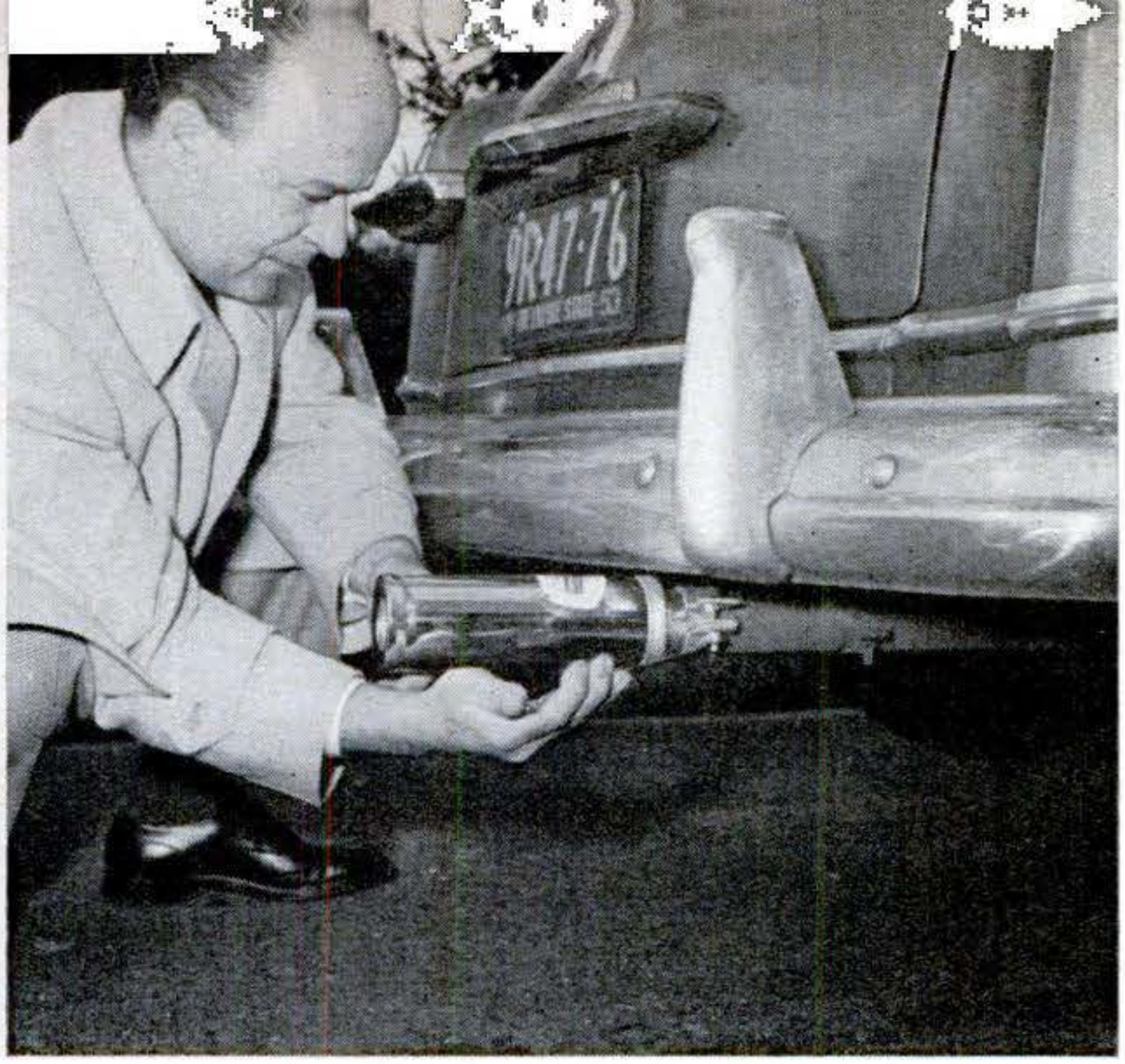
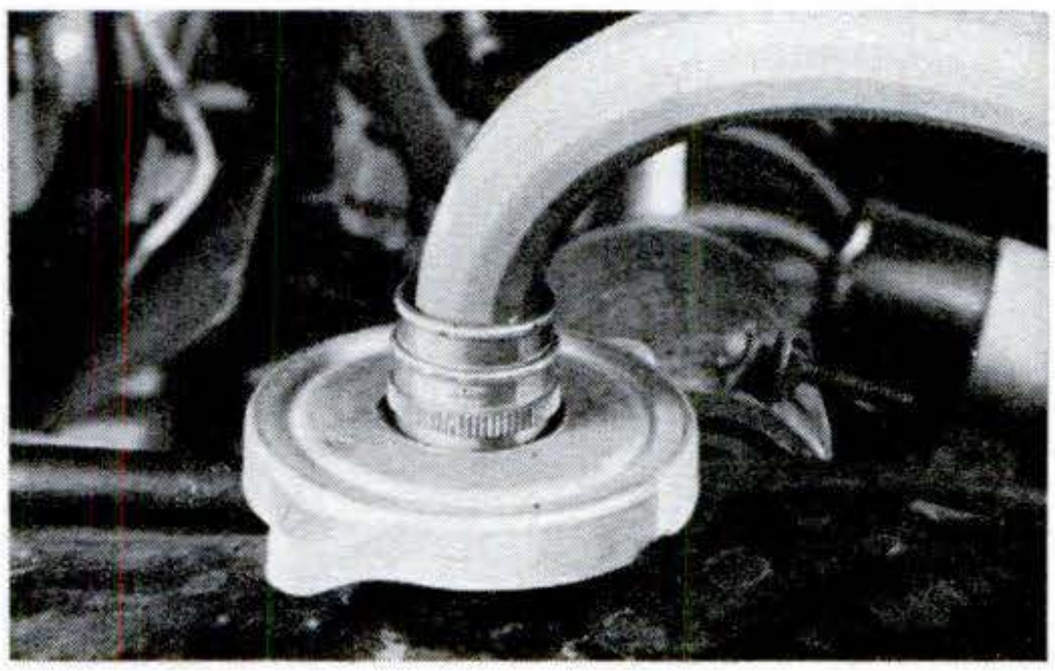


New Accessories for Your Car

1. Exhaust Extension Muffles, Too. Packed with glass fiber, this decorative tailpipe extension takes some of the blast out of exhaust systems using straight-through mufflers. It also cuts noise in standard mufflers. Installation requires cutting off several inches of tailpipe so the extension won't protrude beyond the bumper.



2. Hose Flushes Radiator. This special radiator cap connects to an ordinary garden hose so you can flush the radiator with water pressure when you drain the winter antifreeze. The lower radiator hose is first disconnected or the drain cock opened; then the water is turned on and the pressure gradually increased until it flows rapidly through the tubes.

3. Anti-Rattlers Stop Window Noise. Windows that rattle in loose or worn window channels can be steadied and silenced with these metal clips. They are pressed into the channel with the window lowered; raising the window forces them in snugly. Small curved springs in the clips bear against the window edge, yet permit it to slide up and down freely.

4. CO_2 Cylinder Fights Fires, Fills Tires. A spring clip that can be bolted to the firewall or side panel under the dash of your car holds this dual-purpose, carbon dioxide-filled cylinder ready for quick action for extinguishing a fire or inflating a leaky tire. A short length of rubber hose with a threaded connector to fit a tube valve is included for quick attachment to the tire. The cylinder comes fully charged, and when exhausted can be returned to the manufacturer for refilling.

Please turn the page for more auto accessories.

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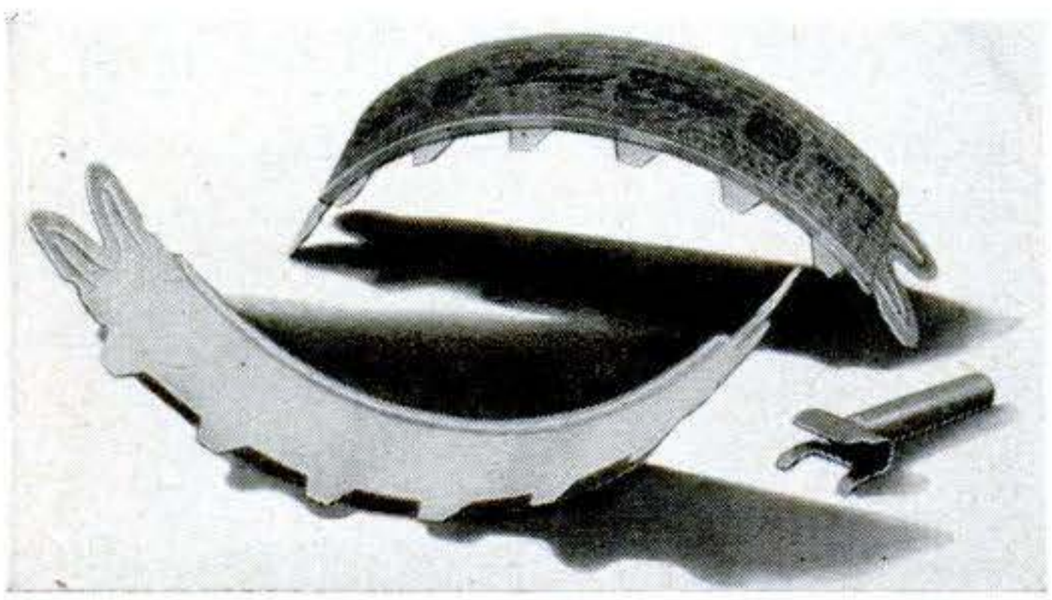
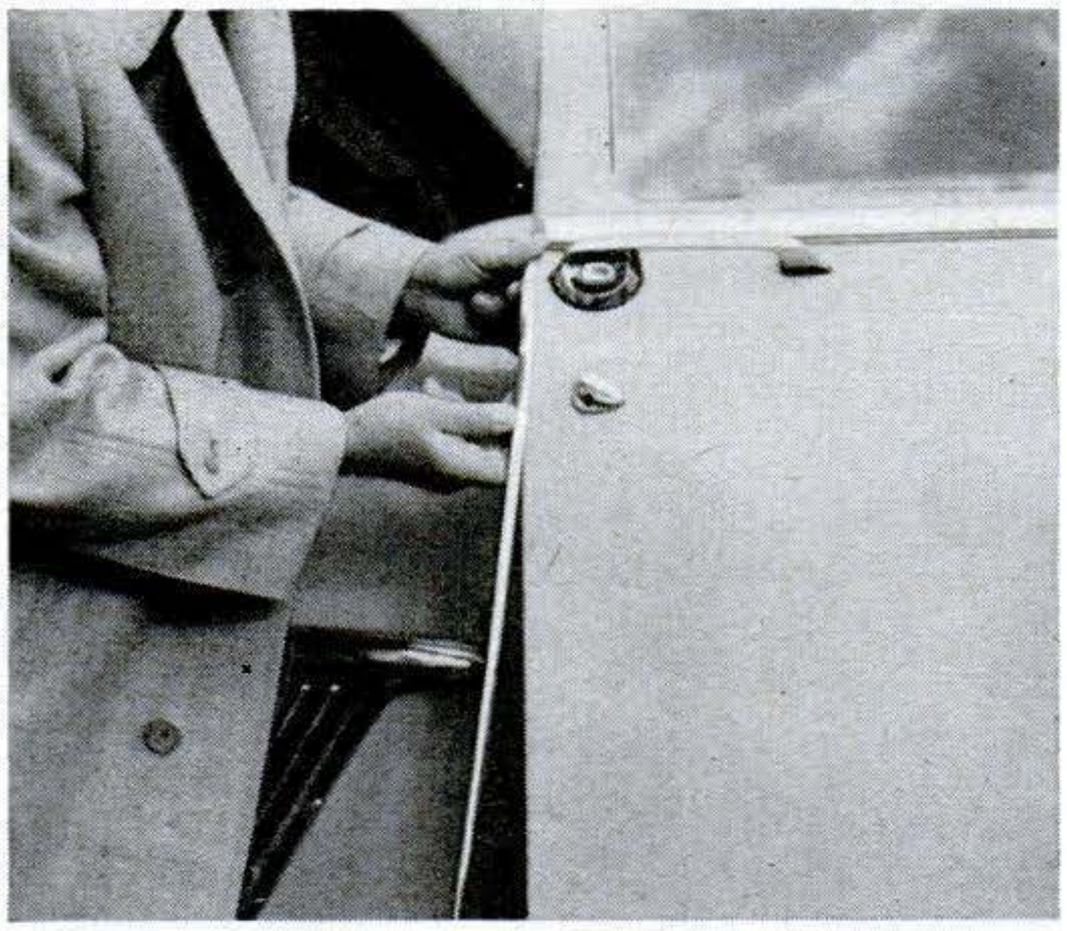
More Auto Accessories

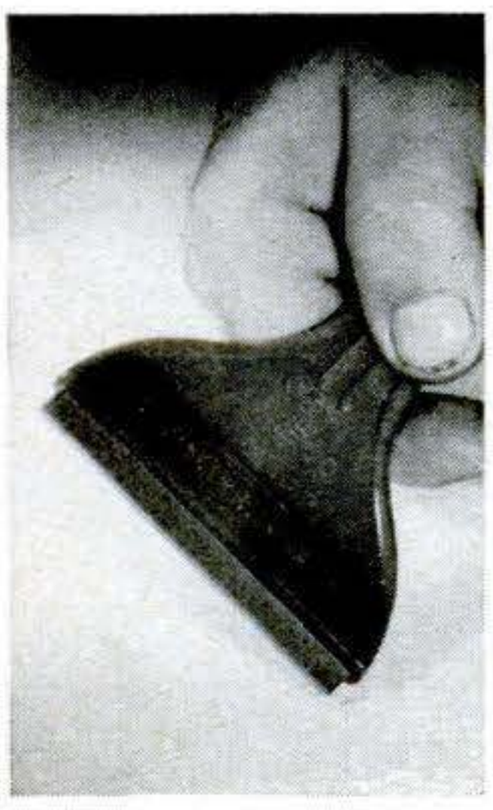
5. Liquid Melts Ice, Stops Fog. This liquid added to your automatic windshield washer or sprayed on by hand will quickly melt ice so that it can be cleared off by the wipers. The chemical can also be used on the inside of the windshield and windows to prevent fogging of glass. Just spray it on and wipe it dry.

6. Plastic Cuts Sun Glare. Pasted on the inside of your windshield, this colored-plastic strip is said to do the job of the tinted glass in new cars. The strip is cut to the correct shape, the glass moistened and the plastic pressed on. When all air bubbles have been squeezed out, it lies flat and sticks on.



7. Brake Linings Clamp On. These linings can be quickly clamped to brake shoes with an inexpensive crimping tool, saving the time and work of a bonding job. Bent metal tabs hold the linings on.





8. Squeegee-Scraper. Practically anything that forms on your windshield can be removed with this double-purpose tool. One side of the blade is hard plastic for scraping snow or ice. The other side is a soft-rubber squeegee for quickly clearing off inside fog and outside dirt streaks.

9. Chrome Trim Hides Nicks. Snap this flexible chrome trim over nicked door edges or gutter molding to conceal chipped paint, scratches and rust that tend to form at these vulnerable spots. The strip has a plastic lining. No screws or adhesives are needed to install it.

Further information on these products can be obtained from: 1. Hollywood Deep Tone Mfg. Co., Los Angeles 7; 2. Pat-Lo Enterprises, 228-56 Mentone Ave., Laurelton 13, N.Y.; 3. Kastar Inc., 200 Lincoln Ave., NYC; 4. General Air Products Corp., 5345 Kedzie Ave., Chicago 18; 5. Lyk-Nu Co., 279 E. 139th St., NYC; 6. Banner Mfg. Co., 37 Preston Court, Brooklyn 3, N.Y.; 7. Russell Mfg. Co., Middletown, Conn.; 8. Tweco Products Co., Box 666, Wichita 1, Kan.; 9. West Coast Products, Los Angeles.

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Vacuum Motor Powers Edger

Salvage the power unit from an old upright cleaner and you can build a handy lawn trimmer.

By John Rogers

YOU can trim your lawn without trimming your budget with this inexpensive homemade edger. You take the motor from an old upright vacuum cleaner, add a blade and a handle, and you have a powerful electric trimmer that will quickly cut a razor edge along walks and curbs, saving hours of backbreaking hand clipping. Parts cost less than $10, even if you have to buy the motor, and the result is comparable to commercial edgers costing $60 and up.

Old vacuum-cleaner motors are ideal for the job because they're small, light, turn at a high r.p.m., and offer a ready-made hous-

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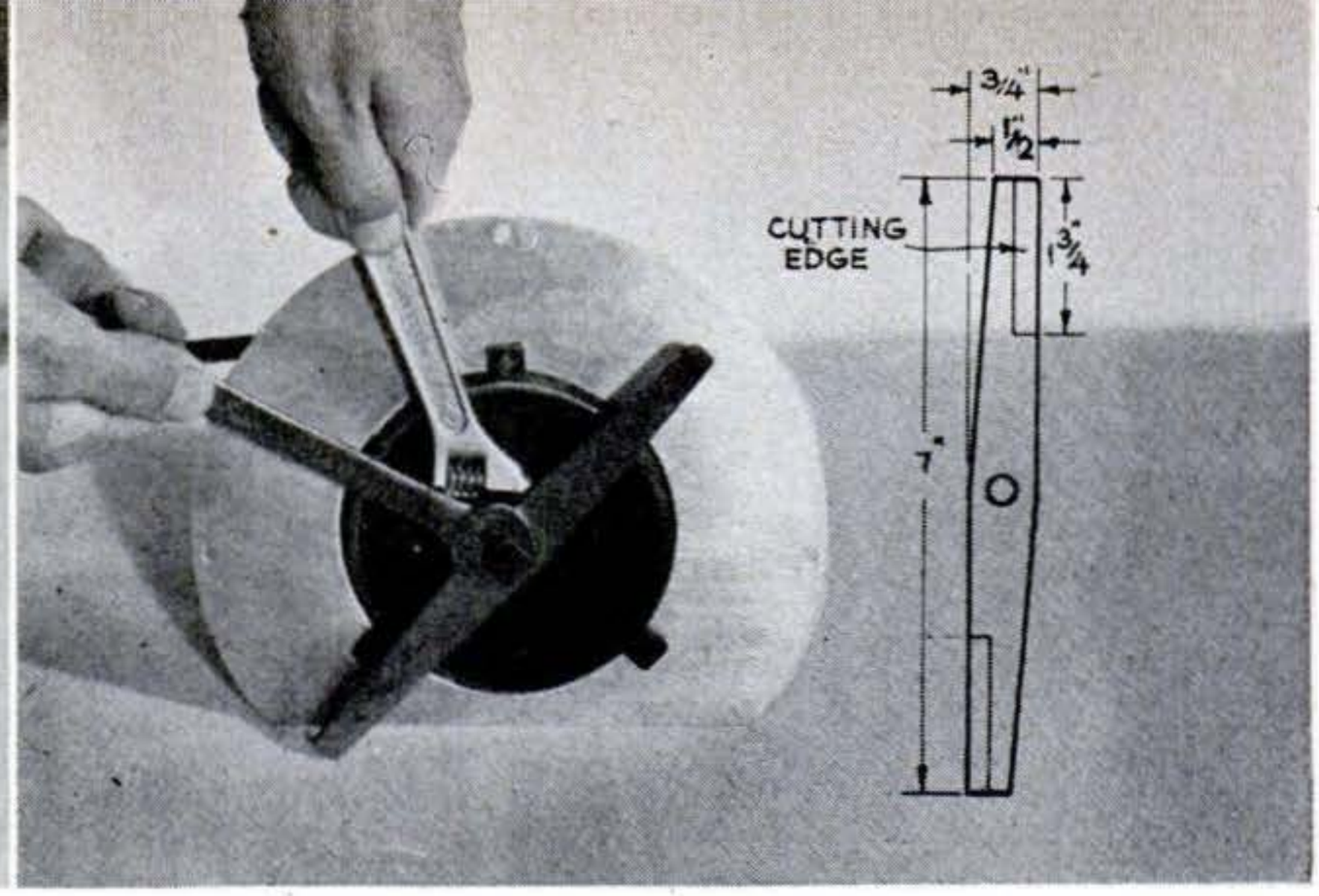
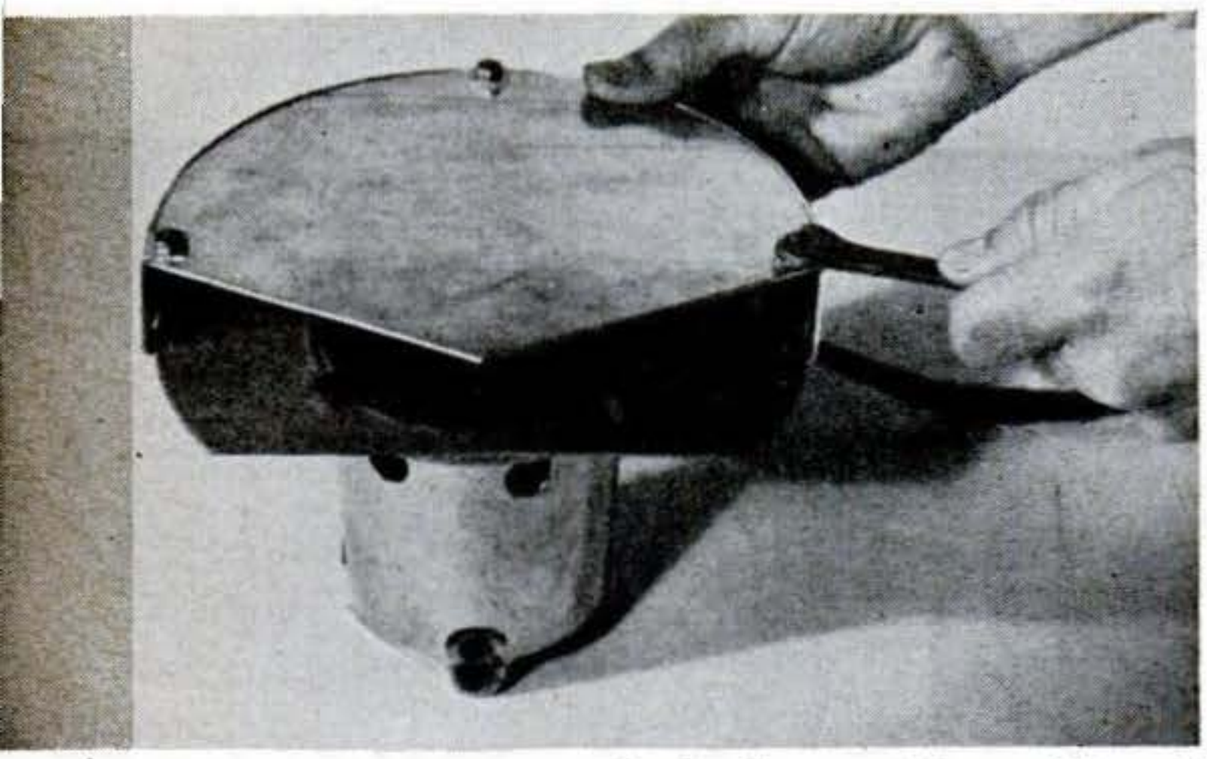
WHEELS can be 2″ rubber casters or original ones on vacuum cleaner if they are about this size. Cotter pins hold wheels on ¼″ axle.



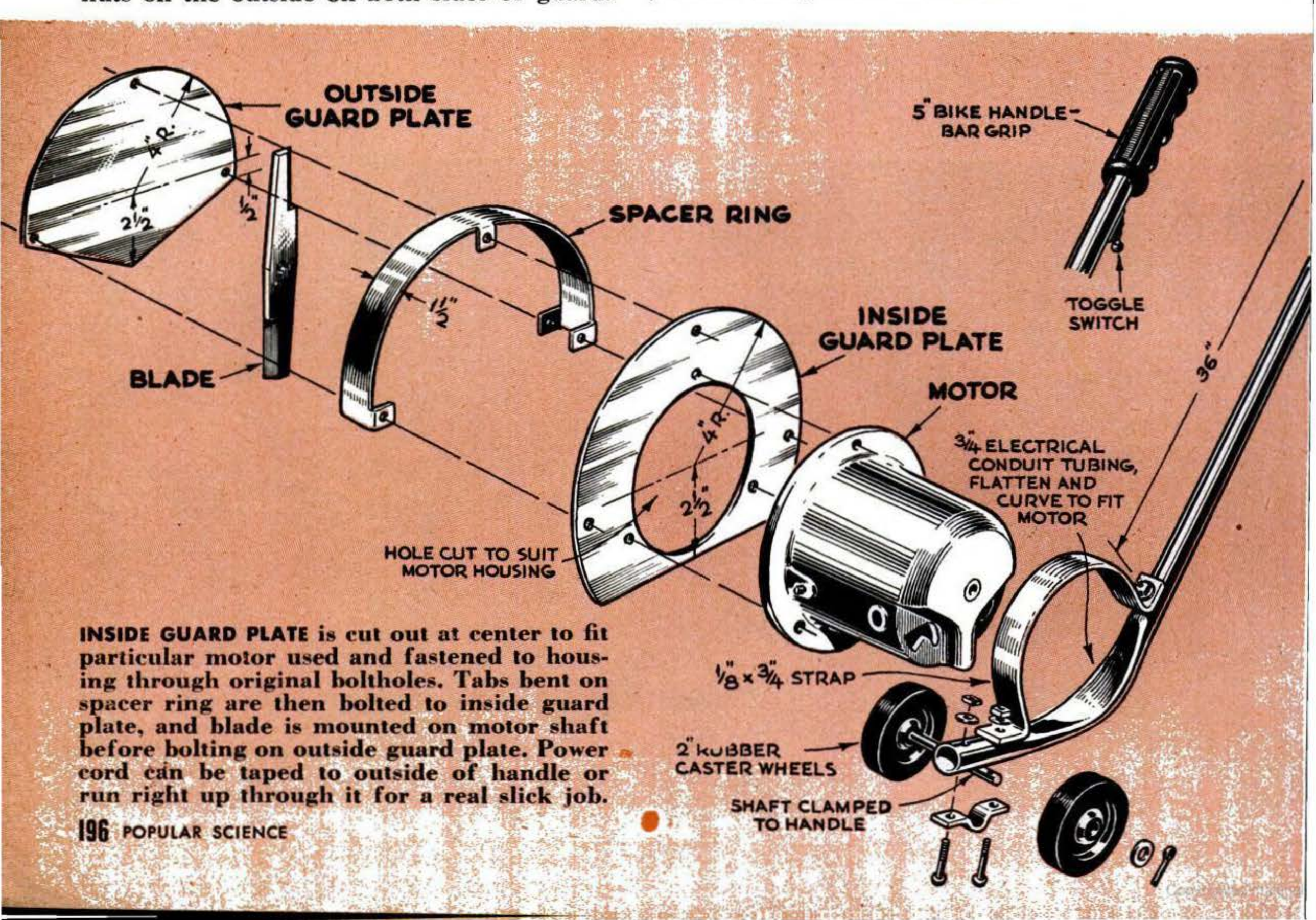
CUTTING BLADE is ⅛″ cold-rolled steel with edges ground on side facing motor only. Two nuts bolt blade to shaft, one on either side.



GUARD PLATES are bolted to either side of spacer ring with 8-32 machine screws. Place nuts on the outside on both sides of guard.

ing to which the handle and blade assembly can be easily attached. If you don't have one gathering dust in the cellar, you can pick up a good rebuilt motor from a cleaner-repair shop for a few dollars.

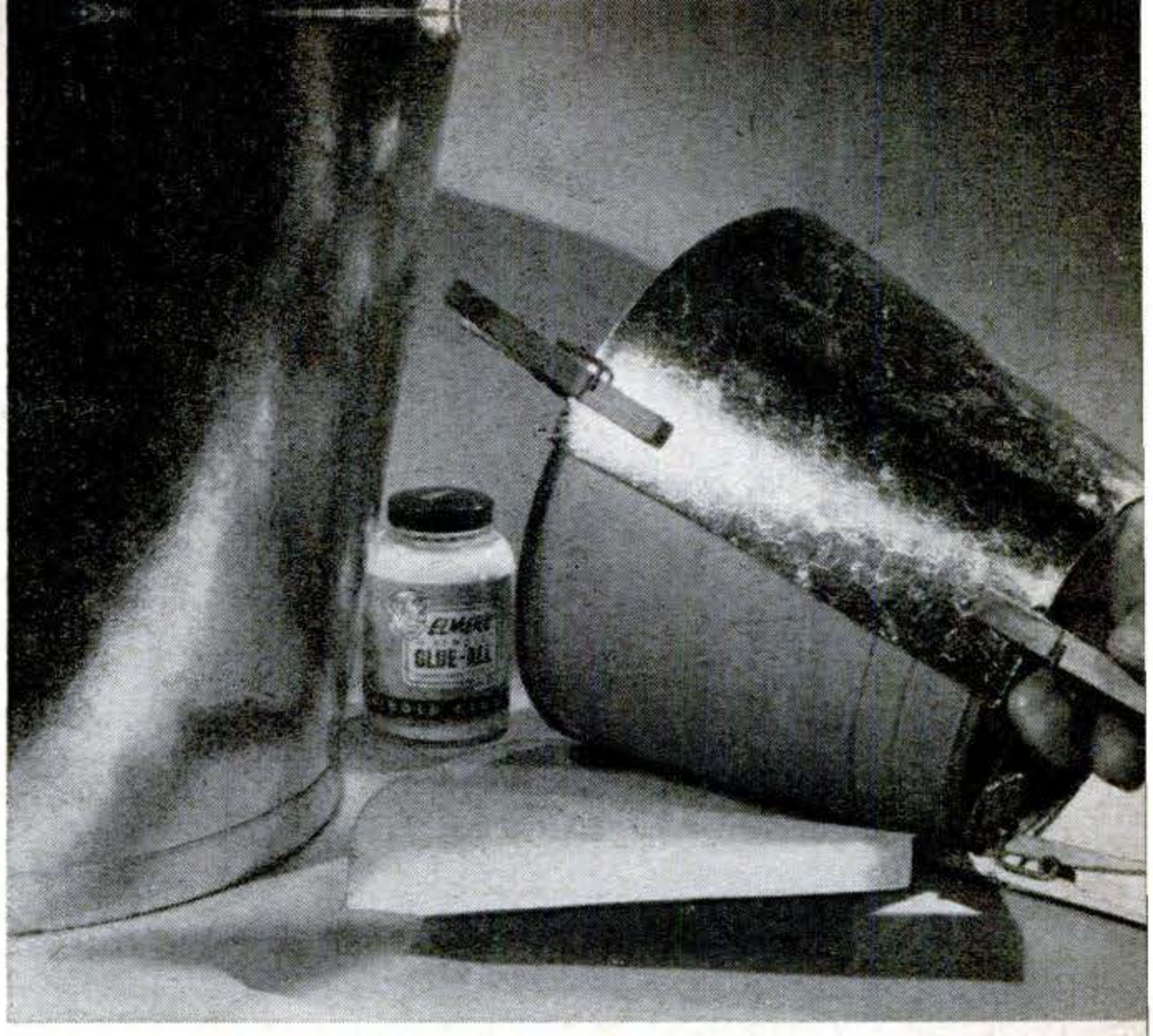
The guard for the cutting blade can be made of .064″ aluminum sheet, shaped as shown, and bolted directly to the motor housing. The power leads are wired to a toggle switch on the handle and terminate in a plug so an extension cord can be used to run the edger, then detached for other uses. When using the trimmer, take care to keep the blade away from obstructions and yourself away from the blade.



INSIDE GUARD PLATE is cut out at center to fit particular motor used and fastened to housing through original boltholes. Tabs bent on spacer ring are then bolted to inside guard plate, and blade is mounted on motor shaft before bolting on outside guard plate. Power cord can be taped to outside of handle or run right up through it for a real slick job.

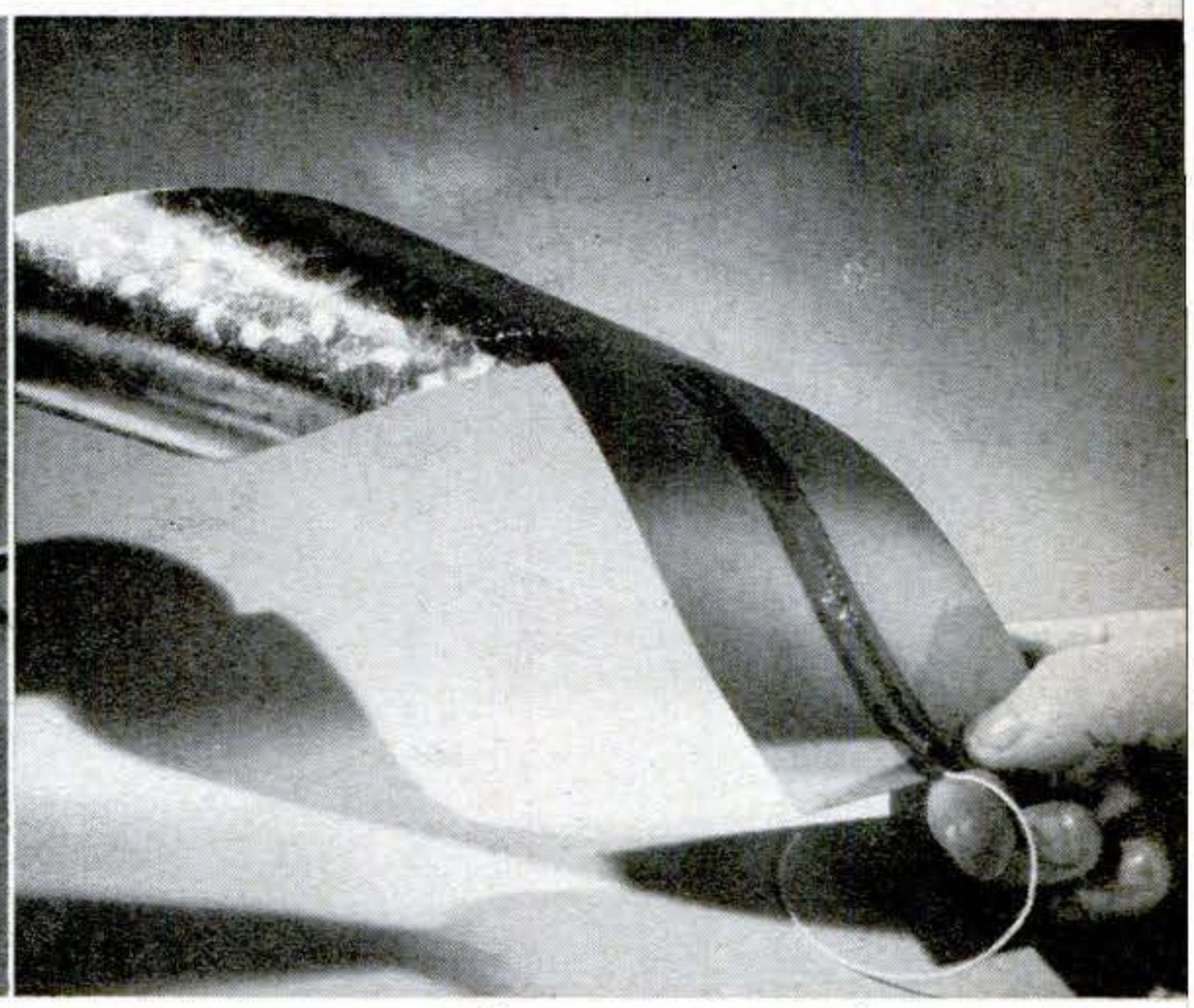
What You Can Do with Aluminum Insulation

Here are some uses you may find around your home or shop for this reflective material.



WASTEBASKET, left, was covered with aluminum insulation cemented in place. An old lampshade can be made to look brighter than ever, as shown at right.

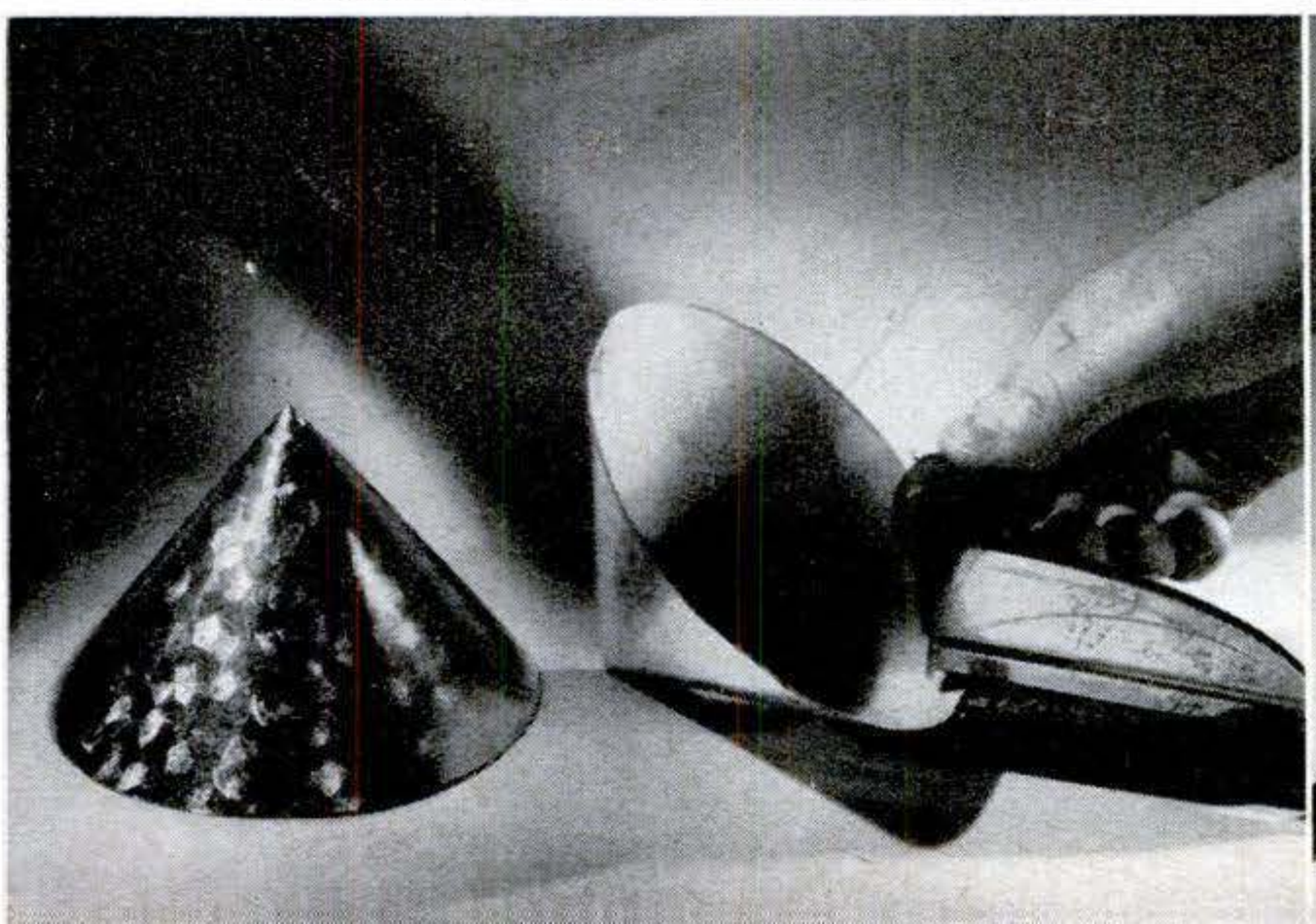
HOUSE NUMBERS and name plates are easy to cut with ordinary shears. Cement the cutouts in place. The material is moistureproof.

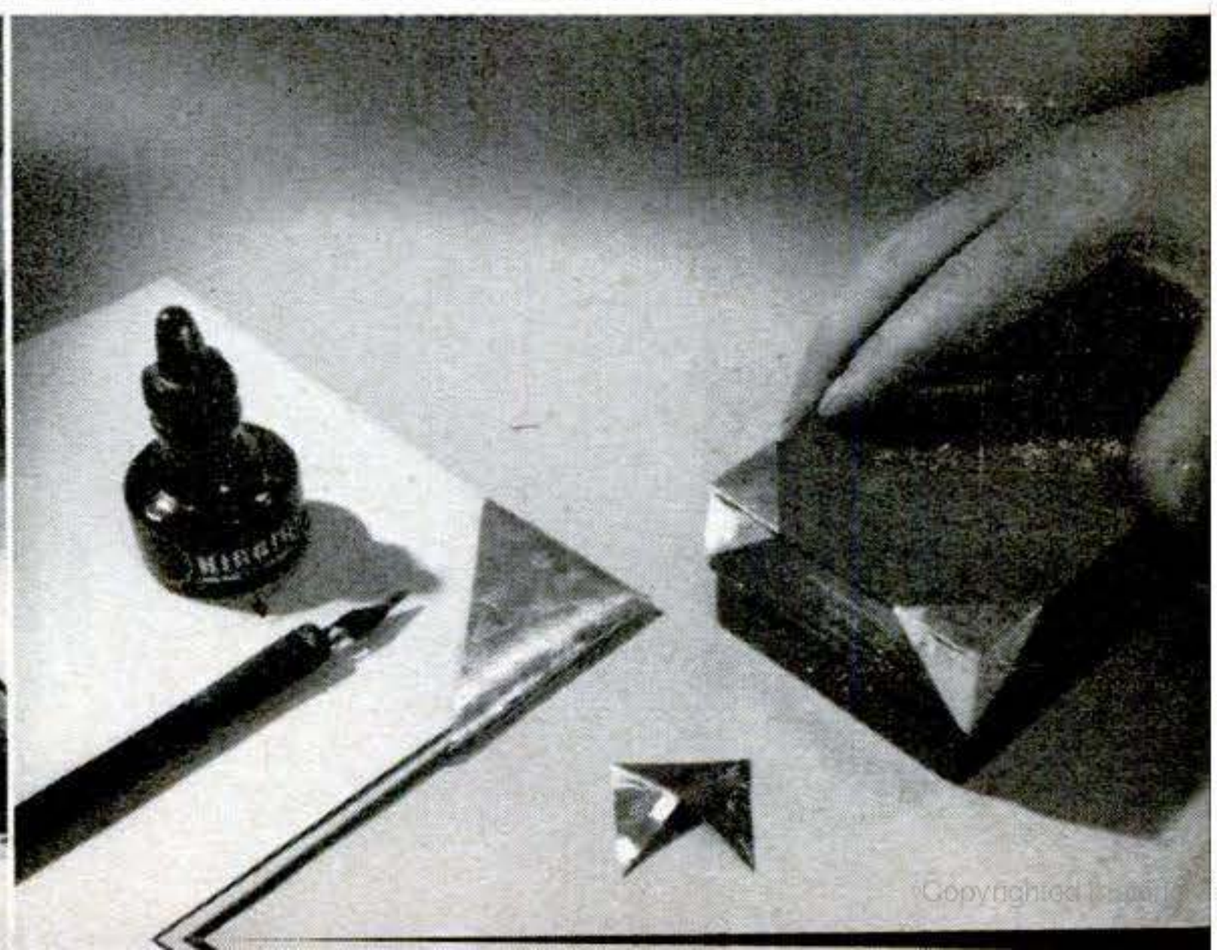


WIND WHIRLERS tied to trees or other supports in the garden or lawn will scare away bird pests. Tape holds the tie cord on.

HOT CAPS for promoting the growth of young garden plants can be made by shaping insulation into cones and stapling edges.

THIS DESK PAD is heavy cardboard with insulation tabs at corners to hold blotter. Bright corners decorate the gift box at right.





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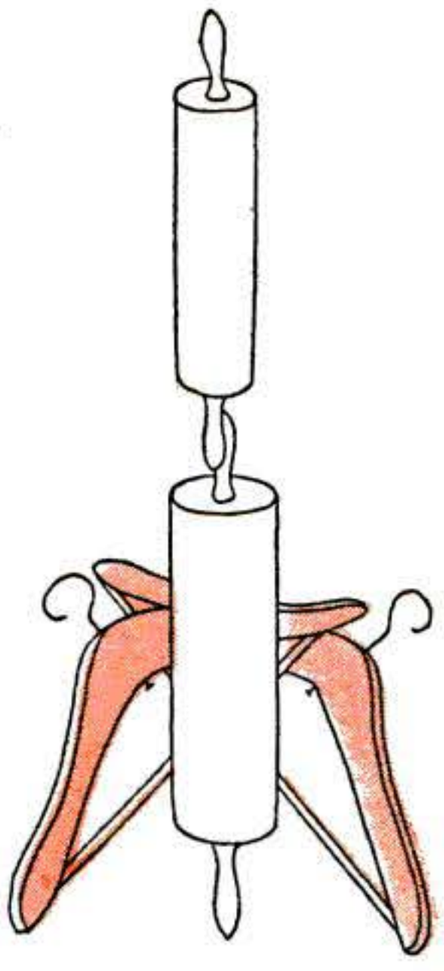
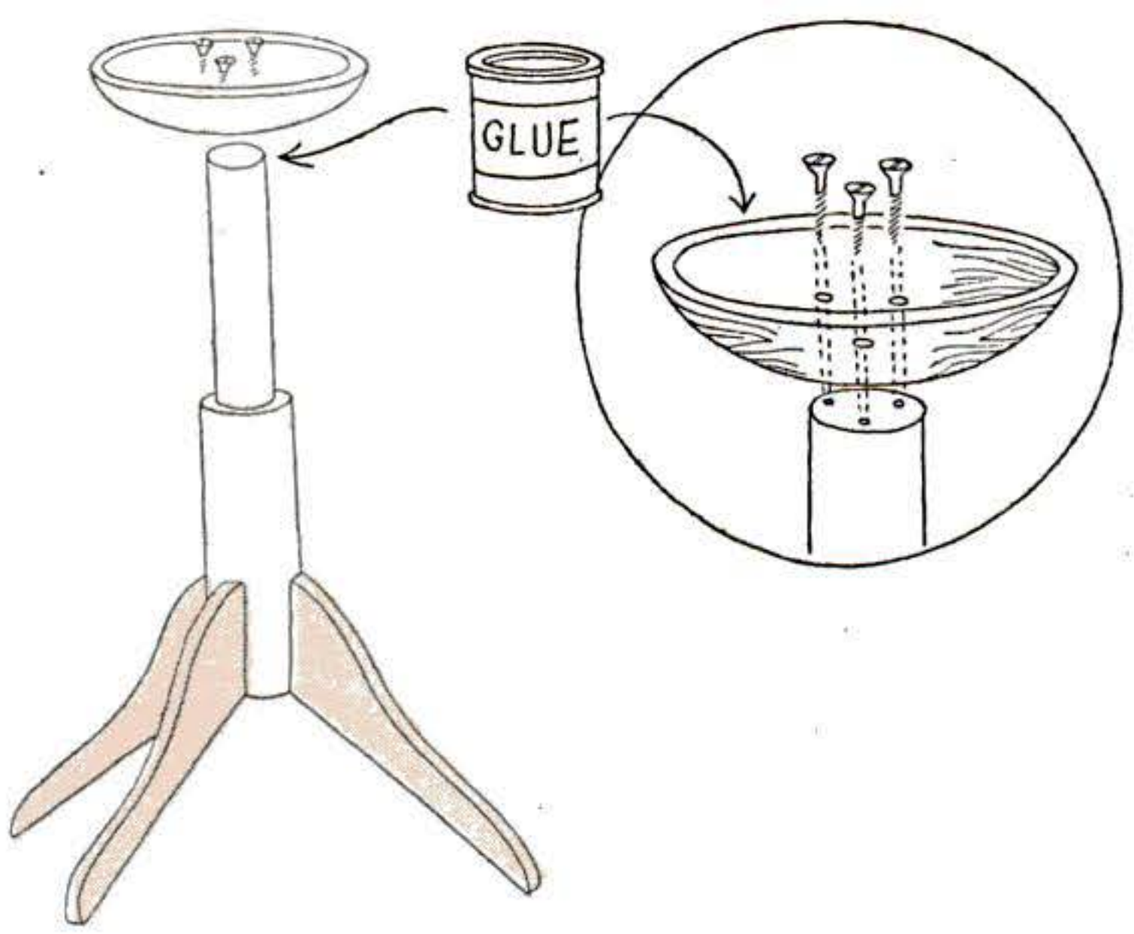
By Roy Doty and Arthur C. Miller

Wordless Workshop





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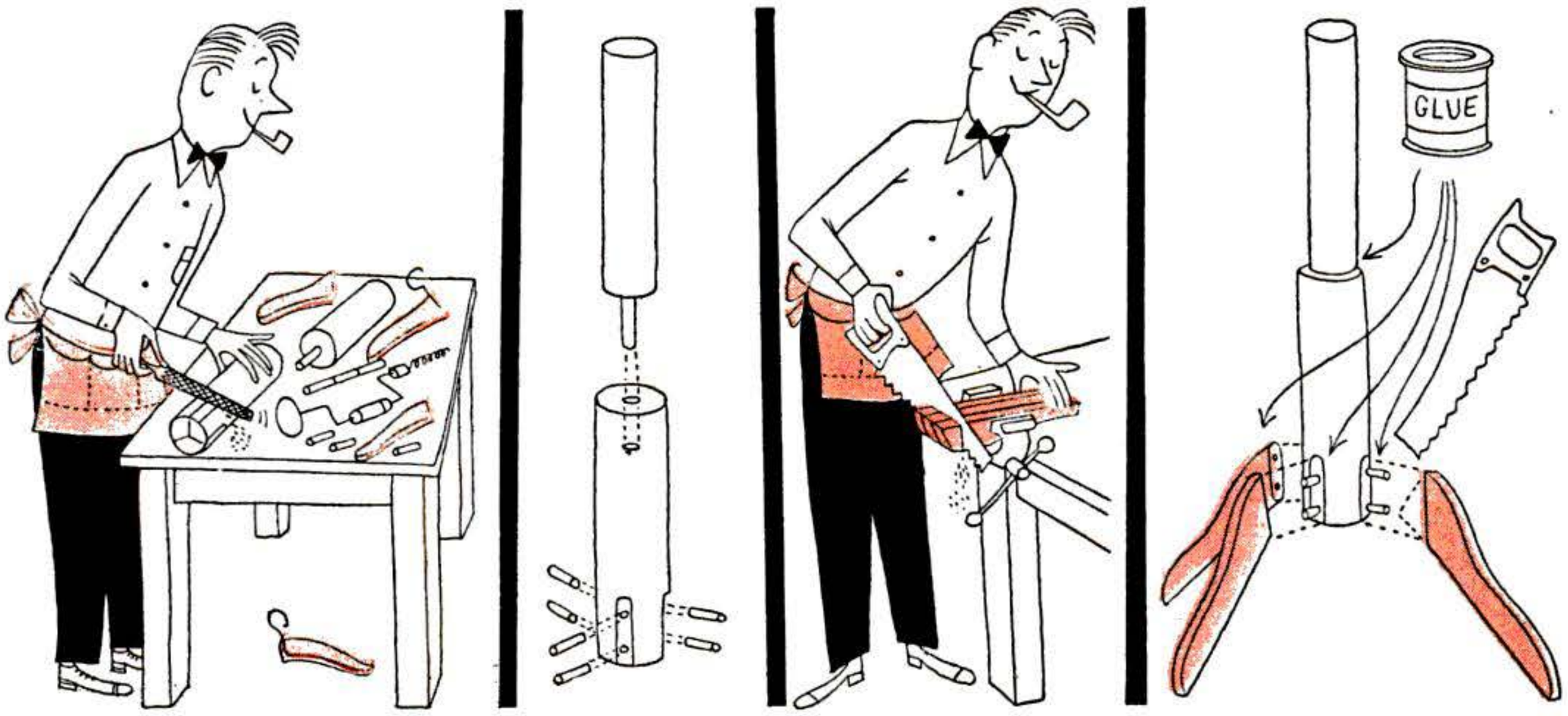

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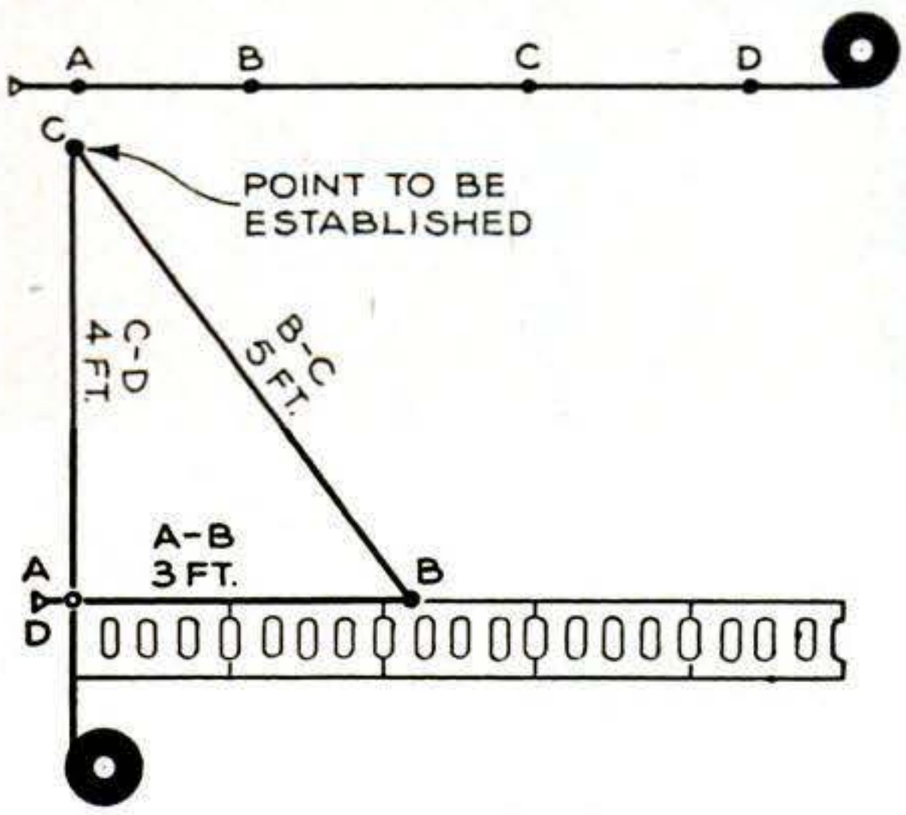
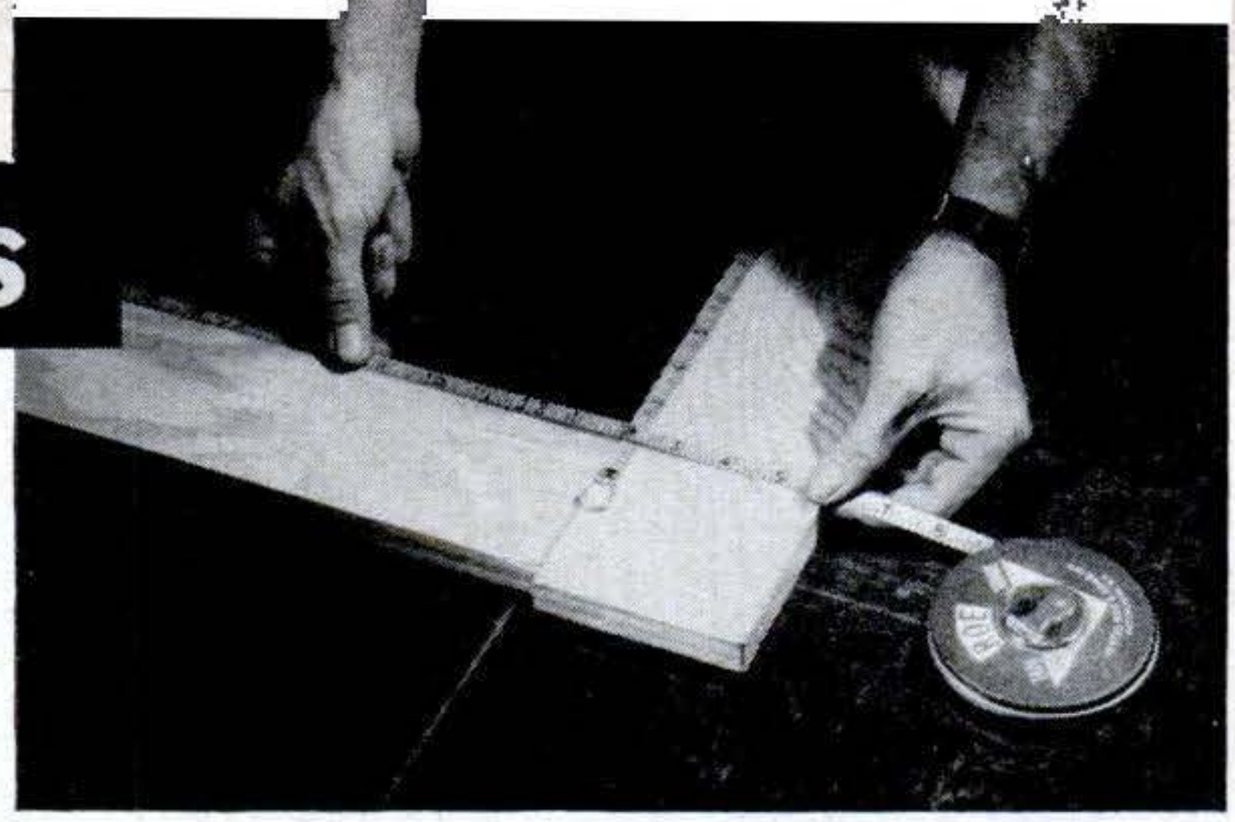
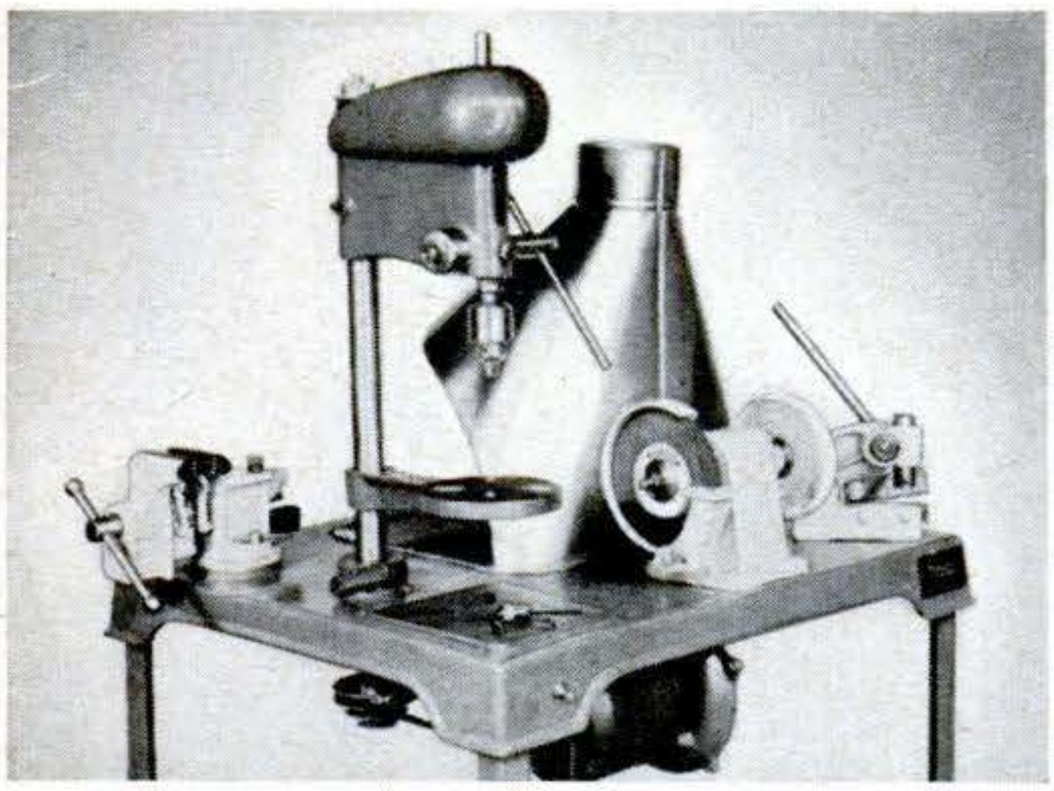
New Tools



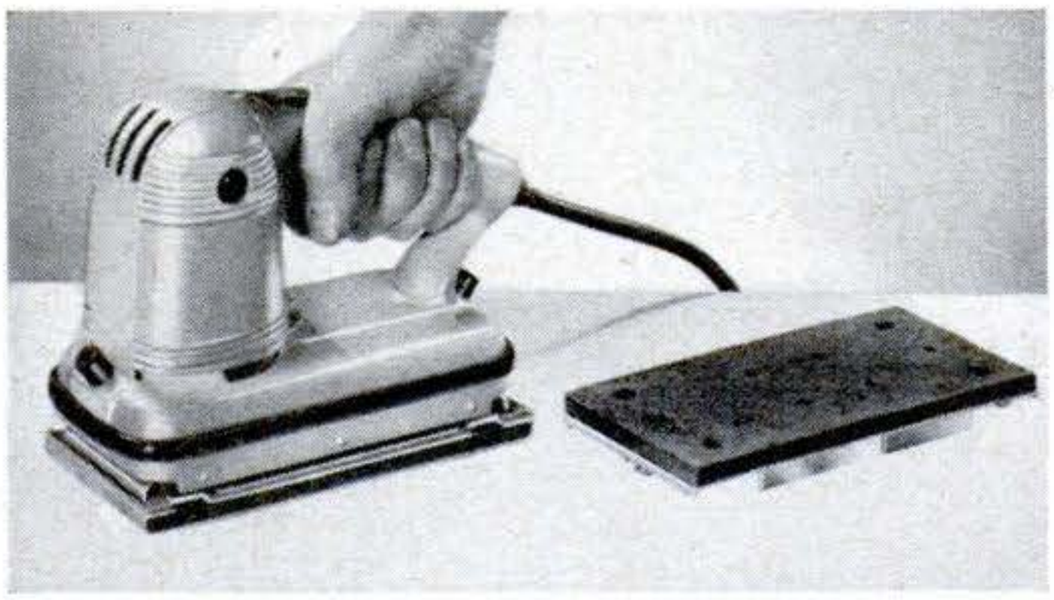


1. Steel Tape Forms Right Angles. This new tape measure can be used to set up a 90° angle. It is jointed in two places so that it can be laid out flat to form a triangle with sides 3′, 4′ and 5′ in length—the proportions of a right triangle.

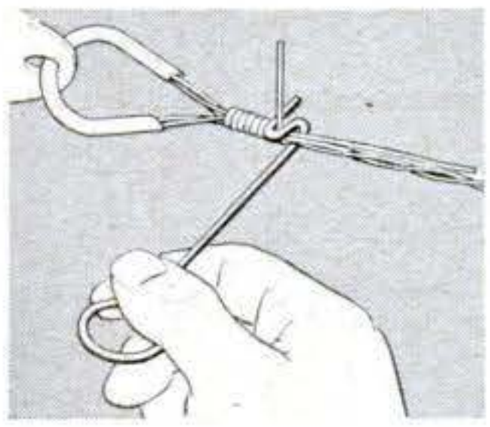


2. No Spreading Chestnut Tree? With this table-top forge shop, the village blacksmith could have packed most of his smithy into less than eight square feet of floor space.

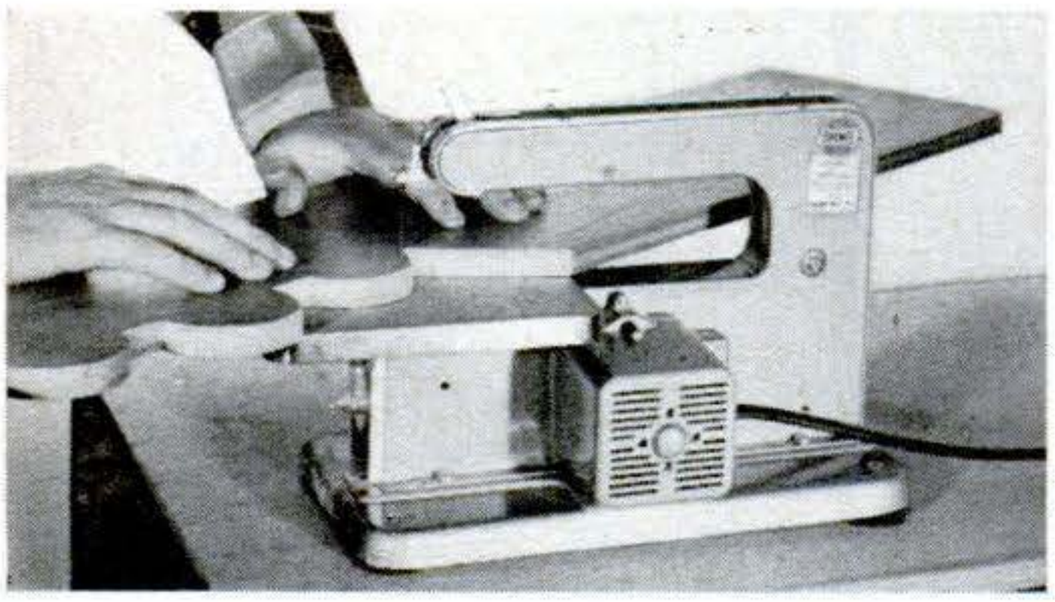
It includes a forge with electric blower, a machinist's vise, drill press, grinder, 3″ shear and a set of hand tools. A ⅓-hp. electric motor powers the drill press, blower and grinder. Since the forge uses smokeless smithing charcoal, the shop can be used in the cellar.



3. Straight-Line Sander Swirls Too. For semifinishing, this sander has an orbital action that cuts fast. For fine finishing work where no swirl marks should show, you can switch to a reciprocating straight-line action. There is a separate sanding plate for each type. Paper is changed by a push-button method.



4. Tool Fastens Guy Wire. With this serving tool, a guy wire can be wrapped around itself to form a neat, strong dead-end without clamps.



5. Built-In Motor Rocks Jigsaw. This new jigsaw has a rocker action that provides power on both the upstroke and downstroke. This, says the maker, eliminates the buckle and whip and resulting blade breakage caused by the tension-spring return of conventional jigsaws. The table tilts to 45°, also raises and lowers. A four-way blade holder permits cutting in different directions.

Further information on these products can be obtained from: 1. Justus Roe & Sons, Inc., Patchogue, N. Y.; 2. Champion Blower and Forge Co., Lancaster, Pa.; 3. Fairchild Industries, 110 Main St., Burlington, Vt.; 4. Copperweld Steel Co., Glassport, Pa.; 5. Dremel Mfg. Co., 2420 18th St., Racine, Wis.

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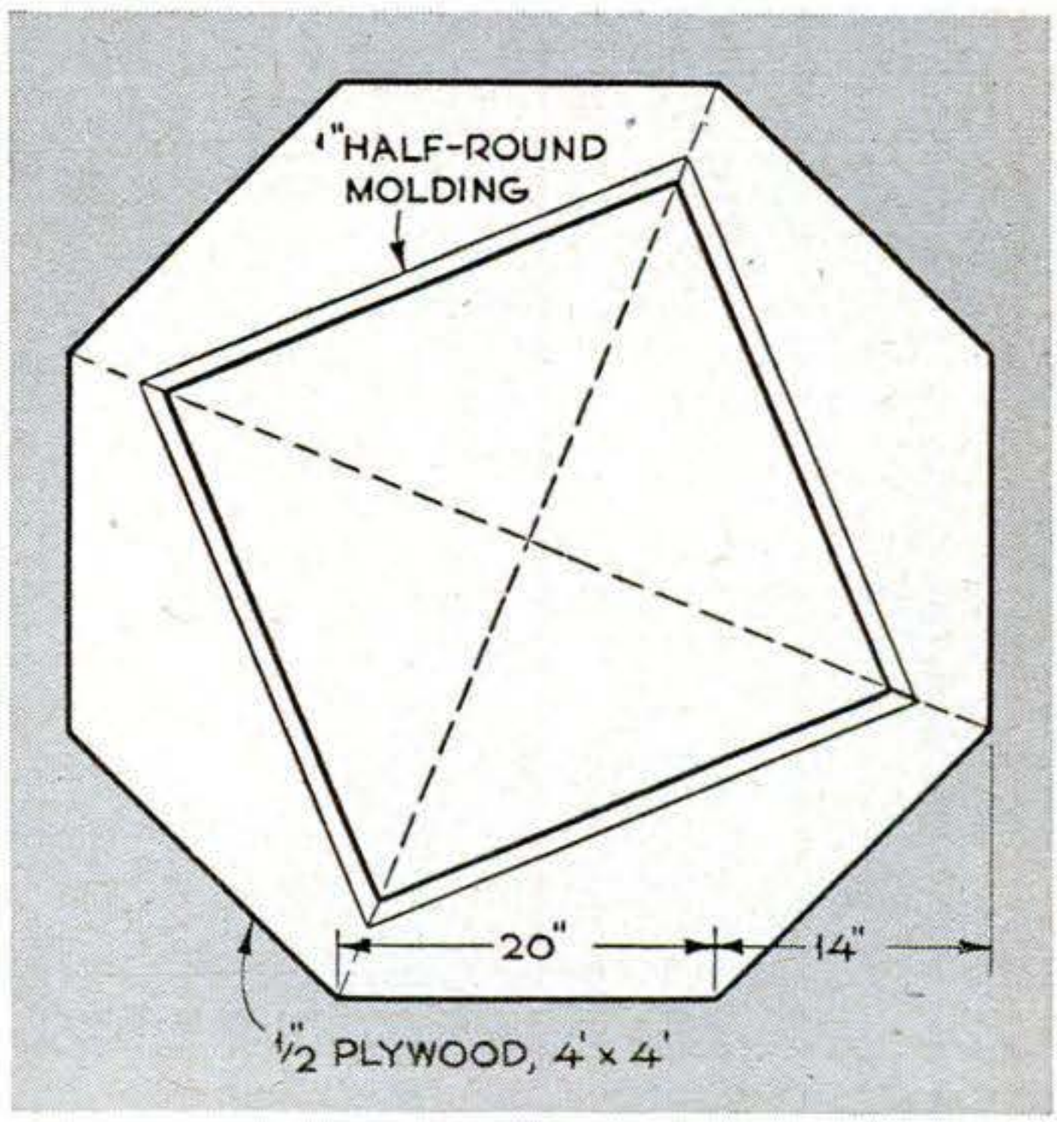
Fit-On Top Expands Card Table to Seat Eight People

BRING this auxiliary table top out of a closet when guests arrive and you'll be able to seat as many as eight people at an ordinary card table. And even though it doubles the card table's capacity, the top provides leg and elbow room for everyone with its octagonal shape.

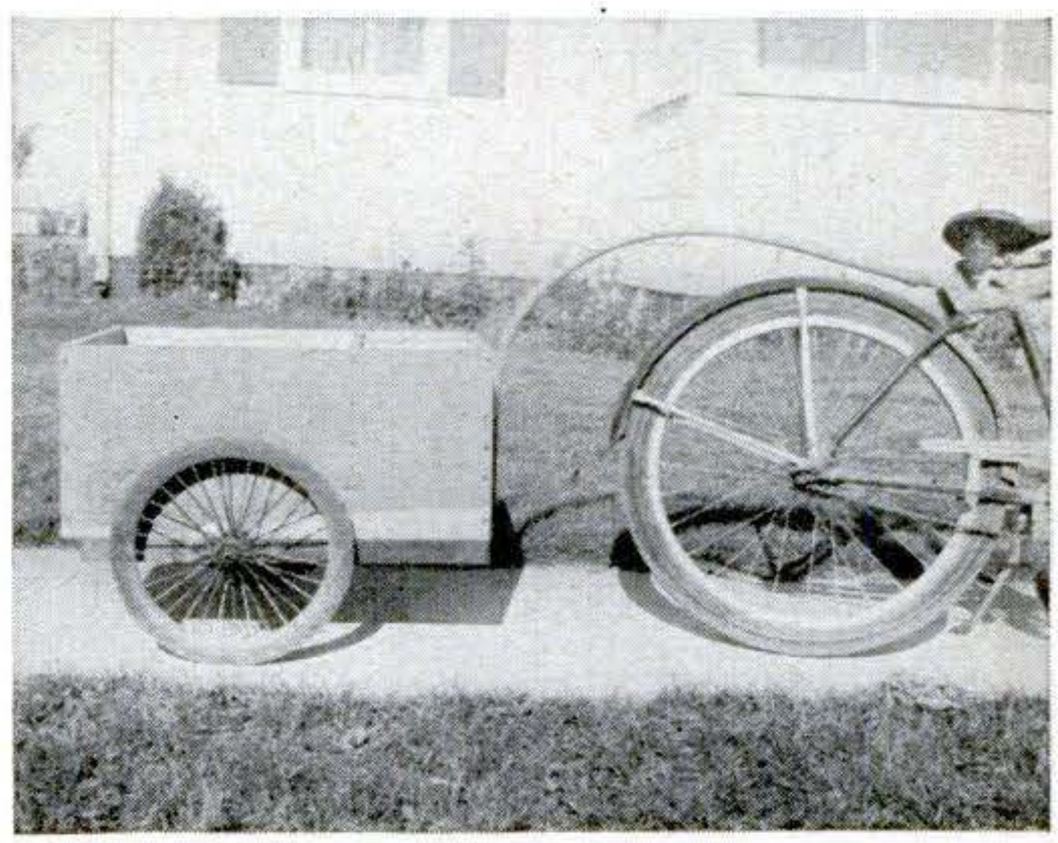
The octagon is made by cutting the four corners off a 4′-by-4′ square of ½″ plywood. A frame goes on the underside to fit easily over the card table. Use four pieces of 1″ half round and glue and nail them on.

Sand the octagon smooth and finish with one coat of plywood sealer and two coats of clear varnish.—*Howard G. McEntee, Ridgewood, N. J.*



Bicycle Pulls Box Trailer

LOADS too big for a handle-bar basket can be easily carried in this bike trailer built by a neighbor of mine. The wheels, which came from a tricycle, are mounted on a simple axle that runs through the angle-iron base frame on which the boxlike body is built. The swan-neck handle, a length of curved ½″ pipe, bolts into a light iron channel on the front of the box. A snap, welded to the other end of the handle, fastens to a bolt held in a heavy iron U welded to the frame of the bicycle.—*E. V. Reyner, Townsend, Mont.*



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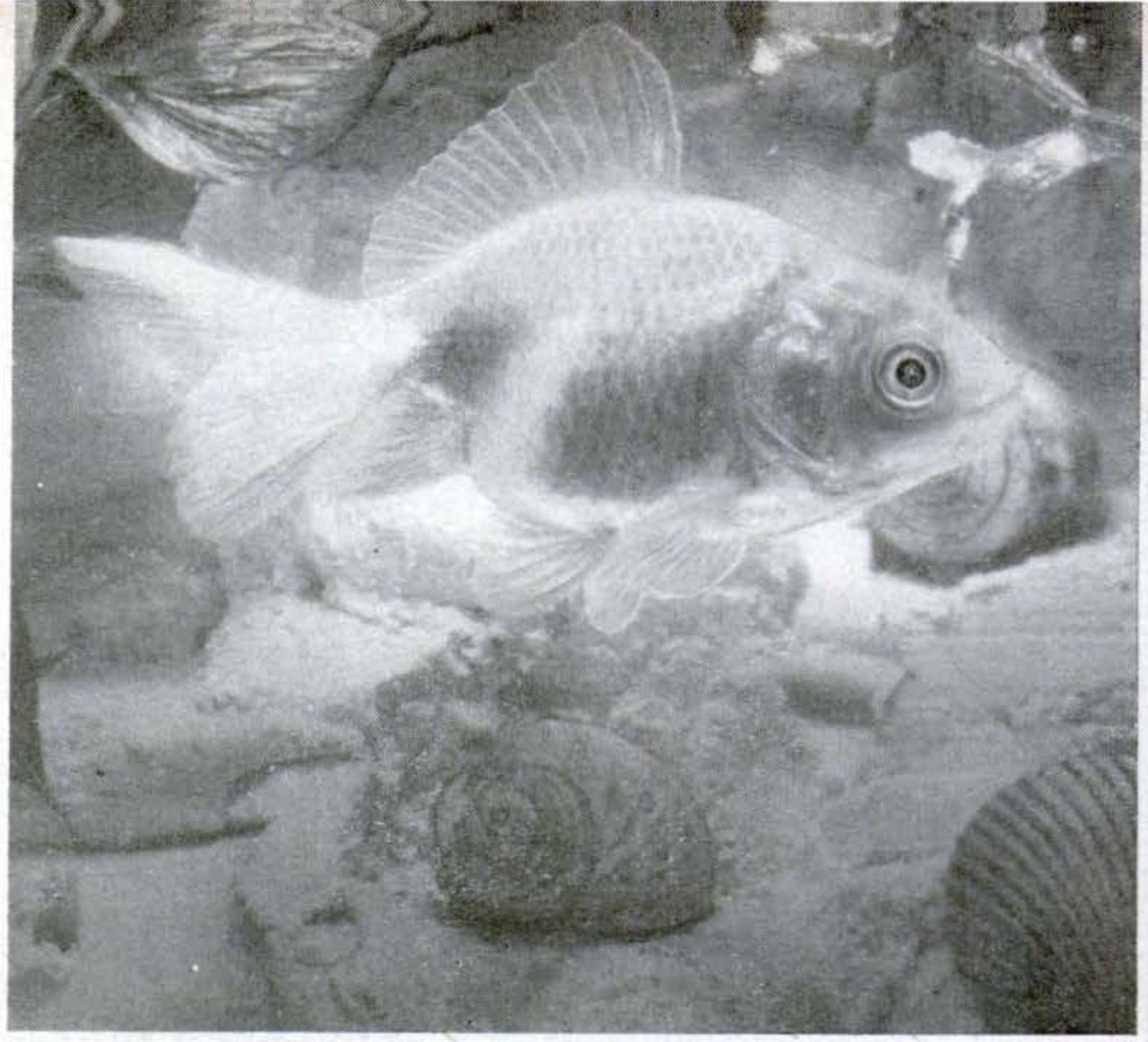
How to Mug a Fish



This homemade tank does for fish what the old-fashioned photographer's head clamp did for wriggly little boys.

FISH-MUGGING TANK is enclosed in a box cut away so that front, back and sides are open for picture taking. Rounded tin replaces reflector on flash gun to throw light down into tank. Press 40 bulbs are used with high-speed film, lens opened one stop wider than usual.

BACKGROUND of picture below is plaster-of-Paris block, dressed up with a few shells.

By David B. Grant

A TROPICAL fish may not be able to emote like Bette Davis, but to an enthusiastic fish fancier like myself he still makes a mighty pretty picture. The trouble is that fish are camera-shy. When I rigged my camera to shoot my fish in their 15-gallon tank, they'd stay out of range for hours—and then not come near the glass on which I was focused.

My new rig, however, holds a fish right up in front of the camera where it can't get away. It's a special photography tank built out of a plastic refrigerator dish. I sealed the cover on with melted paraffin, set the dish on end, and cut a big rectangle out of the new top.

The tank is small enough so that the fish is in camera range most of the time. But to make it even easier, I slide in a glass partition that keeps the fish in the front half of the tank. This slants back at the bottom, giving the fish room to maneuver and turn around.

The flash gun is mounted on a wire rack above the tank. I use a light or dark background to contrast with the coloring of the fish I want to shoot. Before taking the picture, I make sure the fish is in proper focus by sighting on a pencil pushed down into the water.

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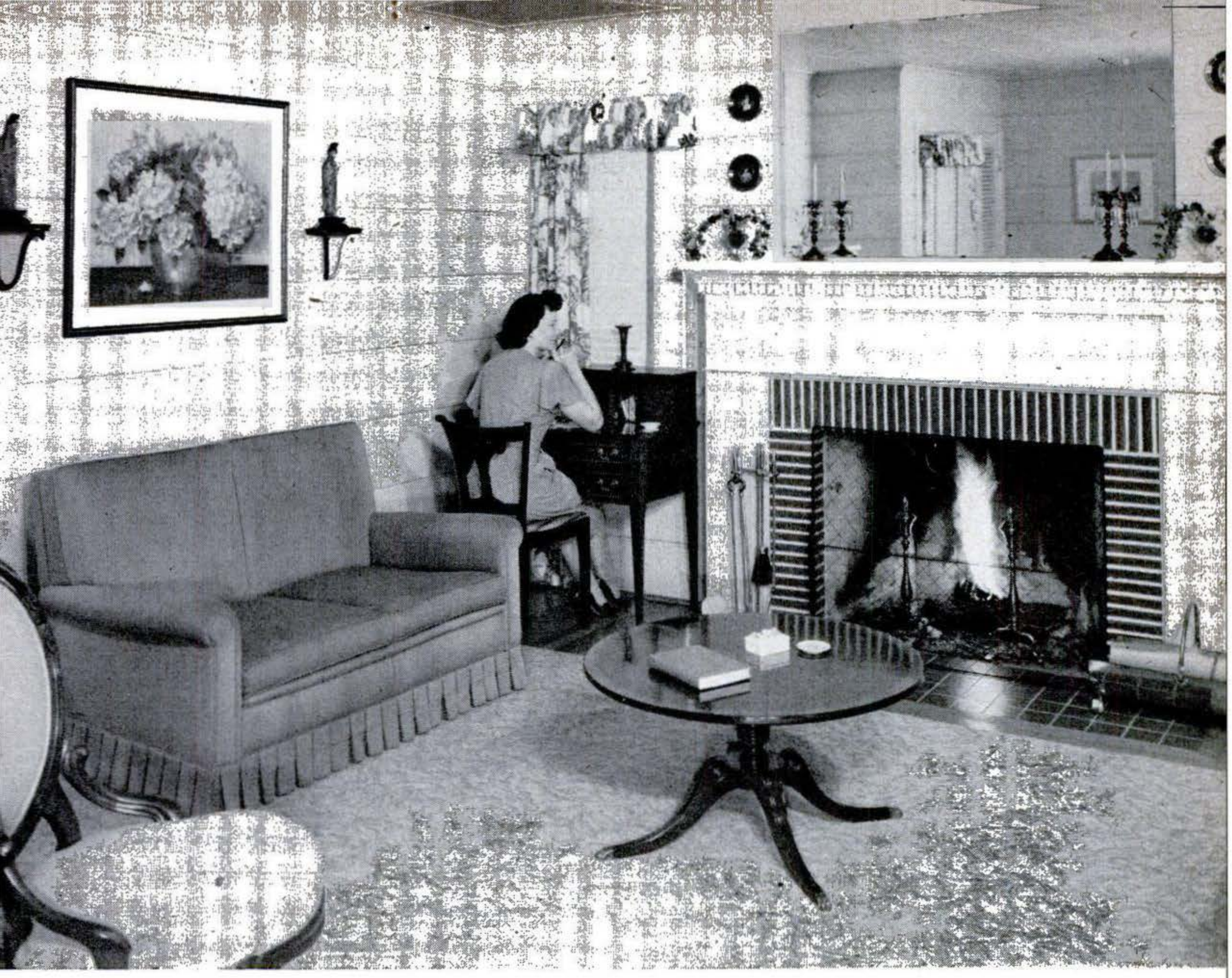

For a handsome wall surface that's simple to put up and easy to take care of . . .

Panel It with Wood

By Darrell Huff

WOOD paneling gives you a lot of wall for little work. Stock paneling in a variety of styles costs little more than a good grade of wallpaper and goes up nearly as fast. Or you can buy plain boards and mill them yourself for special effects.

Either way, the result is a warm, rugged, luxurious wall surface that takes little maintenance. Reasonably cared for, it will last for many, many years.

A little wood goes a long way, so you get a lot of effect without breaking the bank. A single paneled wall will set off an entire room and can probably be had for a weekend's work and a $20 bill. Paneling a damp, dreary basement or an unused attic will transform waste space into usable, pleasant living areas. The effects shown here can be duplicated with materials ranging in price from eight to 25 cents a square foot.

What kind of wood? Any softwood is a good choice. If you're going to paint it, one will do as well as another. But for stain or

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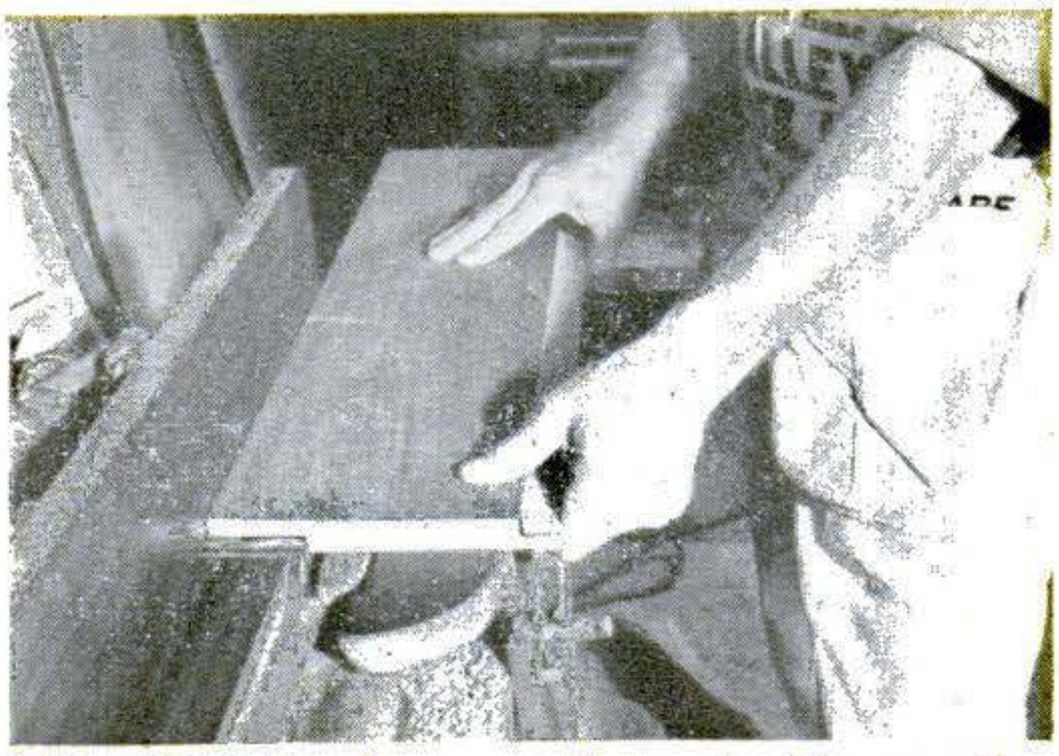
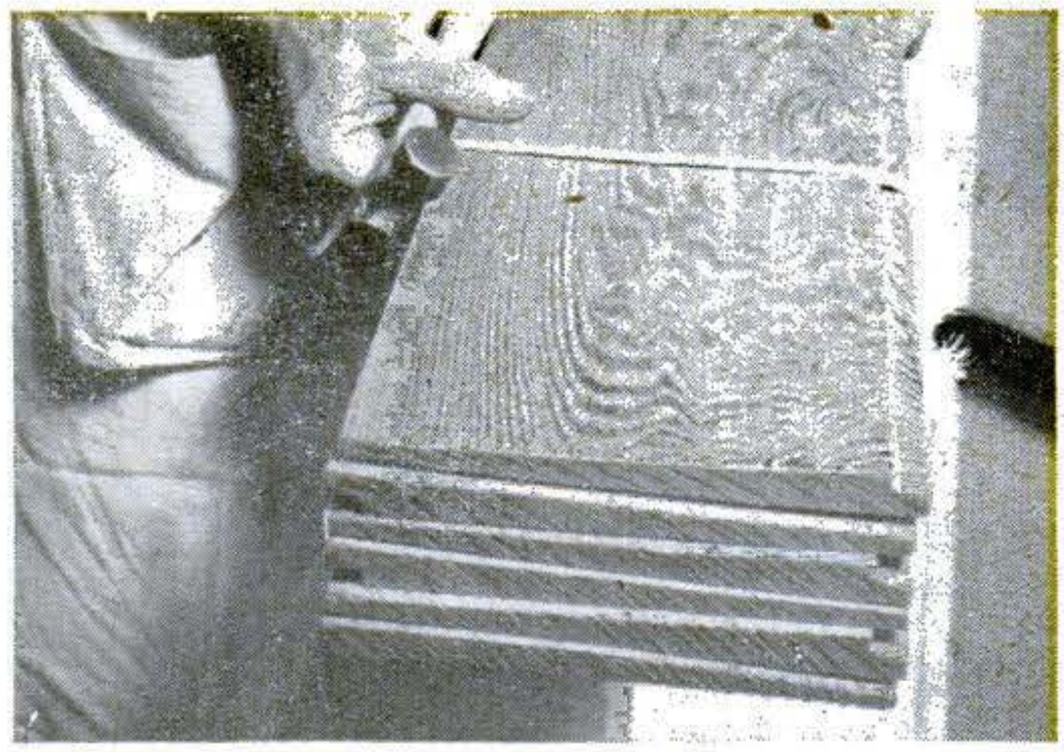
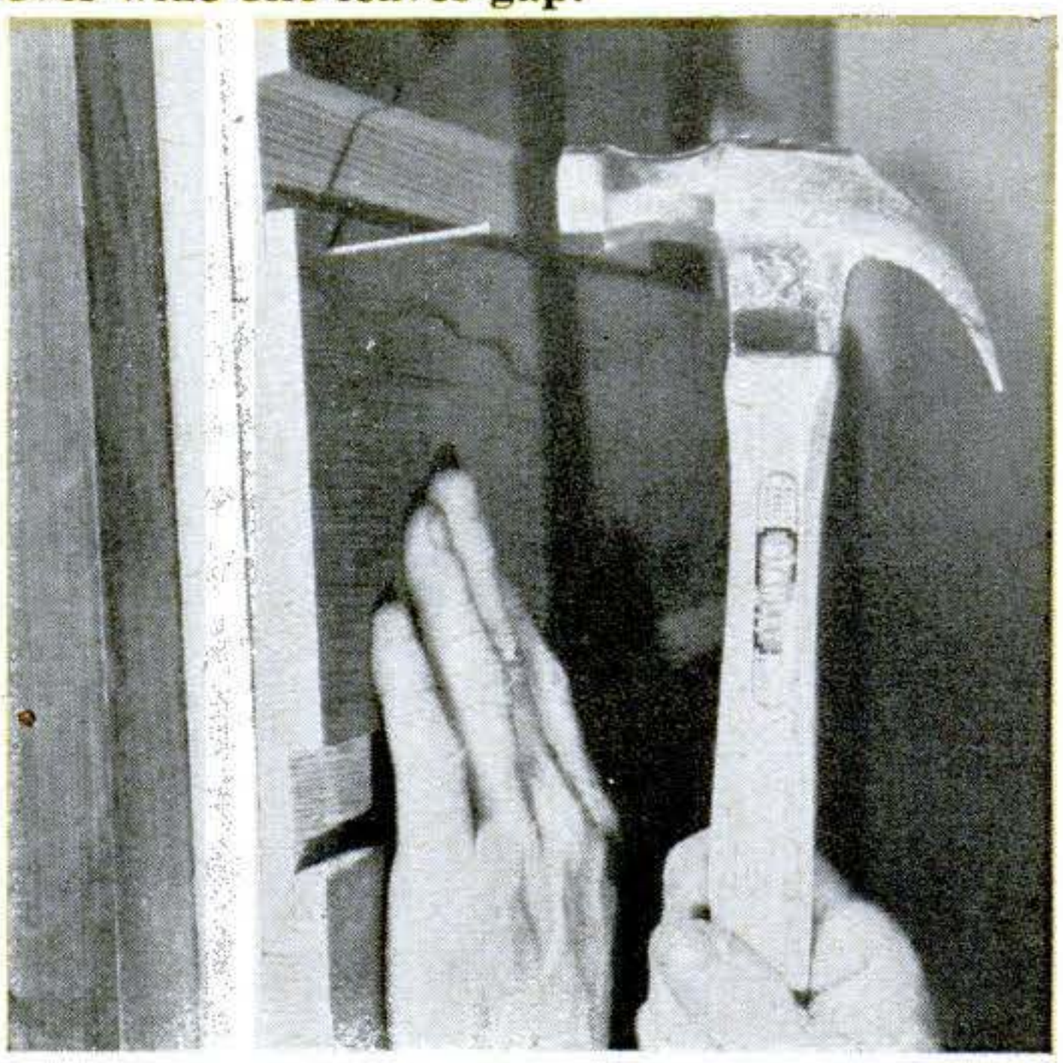
Special Effects You Can Make with Plain Boards

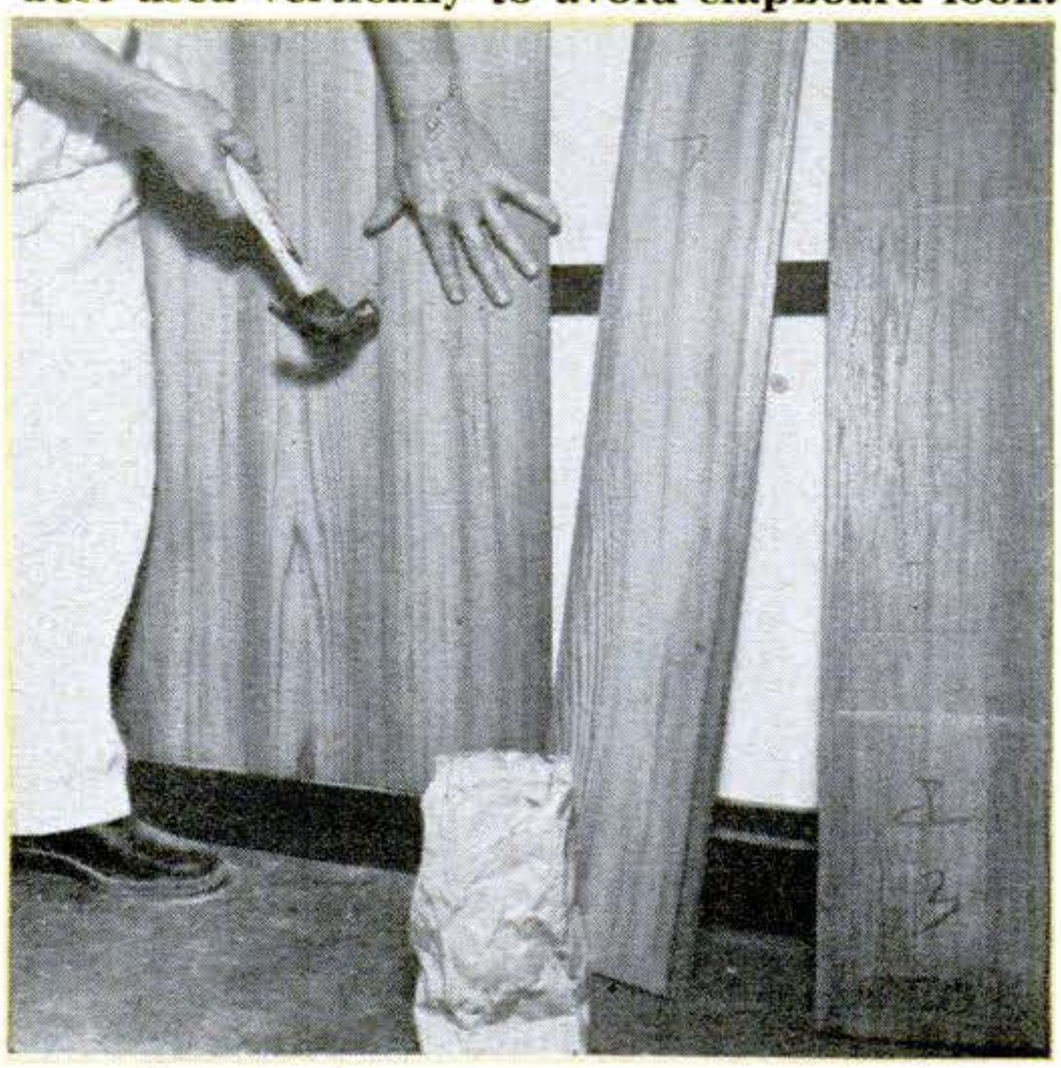


GAP JOINT is clean, modern, looks equally good run vertically or horizontally (below). Boards are rabbeted on both edges with the rabbet on one side made twice as wide as that on other (above). Lapping narrow rabbet over wide one leaves gap.



SHIPLAP JOINT gives interesting, unusual effect, can be made with inexpensive clapboard or lap siding that comes already tapered and rabbeted (above). Boards are face-nailed where they overlap (below), are best used vertically to avoid clapboard look.





INEXPENSIVE PANELING is ordinary knotty pine. Its rustic appearance helps hide defects. Using same wood for built-ins gives rich look, makes use of scrap normally wasted.

natural finishes, the color and grain of the wood become important.

Typical of the light-colored woods used for paneling are the pines and spruces and white fir. Douglas fir is a bit darker. Darkest of the softwoods commonly used for paneling are redwood and the cedars.

Some woods are offered in knotty or pecky grades. In most, the appearance will depend on how much you want to pay. Clear grades may cost several times as much as grades having knots and other defects.

Among these woods, pine is the all-time, all-over favorite and is among the least expensive in the East. Redwood, cheap in the

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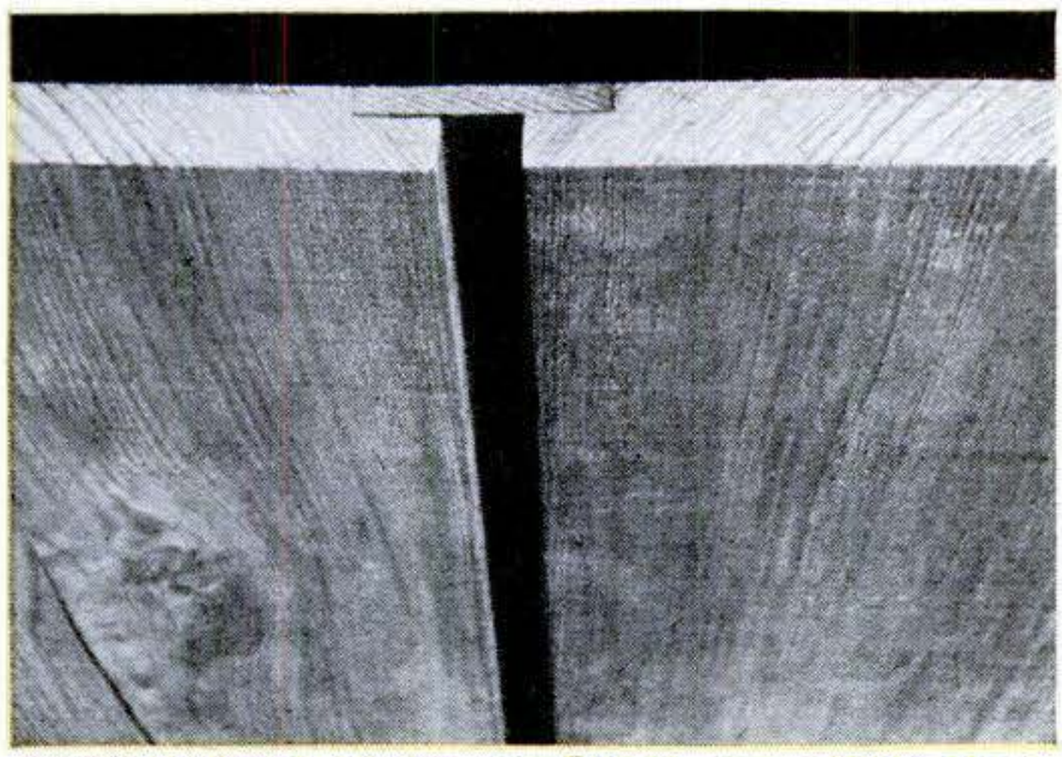
and Ordinary Siding



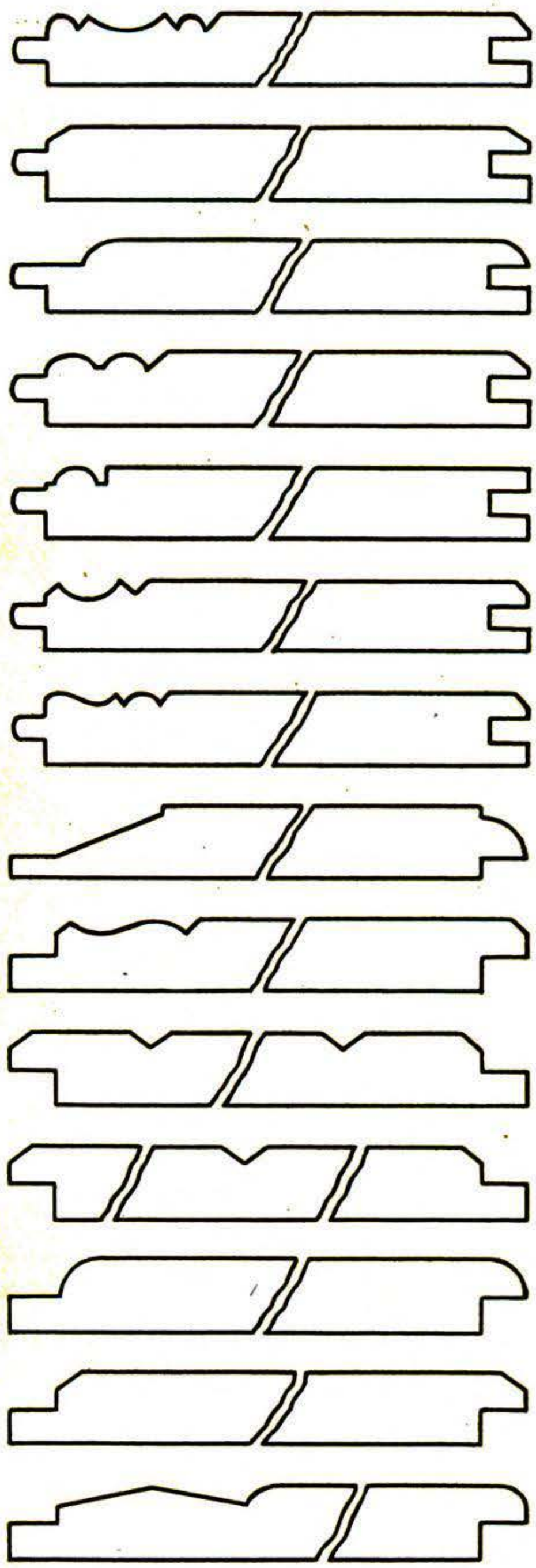
BACK-BATTEN JOINT produces gap effect similar to joint at far left, but edges are all rabbeted same width. First board is nailed in place, then separate backing strip is slipped in behind rabbet (below), and next board is nailed through strip to wall.

West, has worked its way to popularity everywhere. It is especially favored in modern houses.

There is currently one exception to the rule that hardwoods come high. That is Philippine mahogany. It may cost little more than fine grades of softwoods. With a clear-lacquer finish, it has a luxurious cinnamon shade.

What joint? Simplest and most popular is a V joint produced by beveled edges. This gives a pleasant pattern and has the advantage of concealing slight slips in workmanship or shrinkage of the boards. V-joint lumber may be either tongue-and-groove or

Ready-Made Paneling Comes in Many Styles



PANEL PATTERNS above are some of available stock designs. Top seven have tongue-and-groove joints. Bottom types are usually cheaper, but require face-nailing at the edges.

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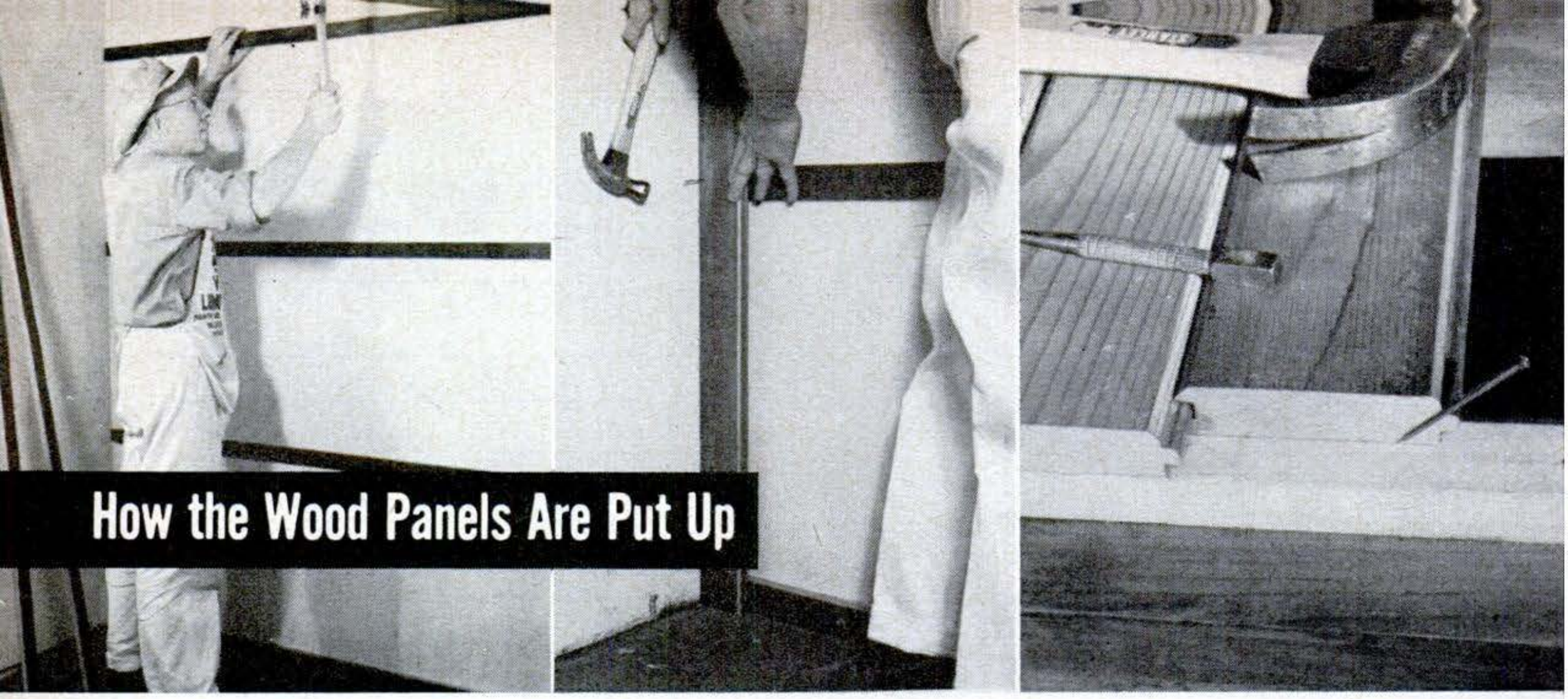

How the Wood Panels Are Put Up

FURRING STRIPS of 1"-by-2" lumber are first nailed to studs through existing wall. Place one strip at ceiling, one at floor, and space others about 2′ apart in between.

STARTING AT CORNER, butt first board against wall, tongue side out, and face-nail rear edge to strips. Tongue edge is then nailed to strips in concealed way shown at right.

NAILS ARE DRIVEN through tongue into furring strips at about 45° angle. Use five-penny finishing nails; if wood splits, switch to four-penny. Groove on next board will hide heads.

shiplap, the latter usually having a broader and deeper bevel.

The advantage of tongue-and-groove paneling is that it interlocks at the edges, concealing nailheads and requiring nailing on only one side of each board. Most other joints require face-nailing and some of them nailing along both edges of each board. If you pick one of these, you'll have to countersink your nailheads and cover them with a matching filler so they won't show.

Tongue-and-groove lumber is also produced with no bevel and gives a plain, flush wall. Some t&g has a bevel on just one side, permitting its use either way. Other joints are shown in the photos and drawings.

Horizontal or vertical? Most paneling is put on vertically, as this eliminates end joints and also avoids the dust-catching characteristics of horizontal joints. Horizontal paneling, however, often makes a room look larger and can also be nailed directly to studs, eliminating furring strips.

V joints are used with most horizontal paneling. Other types of joints are likely to give a barnlike effect or to catch too much dust. If you have a good eye for line, you may find a wall that will look striking when paneled diagonally. This treatment may also be just the thing to add strength if that is needed.

You can buy it or make it. If you can find ready-made paneling to suit your needs, there is no great saving in buying plain boards and jointing them. But if you can't find what you want and have power tools, you may save a good deal by shaping the paneling yourself instead of having it milled to order. A good example of paneling that can't be bought is the back-battened redwood shown in the photos.

Trim is a simple matter with a wood-paneled wall. For horizontal paneling, it usually consists simply of matching quarter-round molding nailed at the ceiling and floor. On vertical paneling, however, the grooves form little pockets at the floor that catch dust. One way to solve this is by first nailing on a narrow baseboard-like strip at the floor line and butting the bottom ends of the boards against it. Quarter-round molding can then be nailed at the ceiling and bottom of the baseboard. Or you can use the molding alone if you fill the pockets with a matching wood filler.

Furring strips. These are narrow lengths of lumber, usually one-by-twos, that are nailed up first to provide a nailing surface in turn for the paneling. You'll need them for all vertical paneling and for horizontal paneling over a masonry wall.

The photos show how the furring is put up, but if you use a baseboard, remember to add an extra strip just above the one at the floor so the bottom ends of the boards will fall on it. In horizontal paneling, make sure all end joints meet at studs and stagger them so they fall on different ones. You can find the studs, usually 16″ apart, by tapping the wall and drilling test holes.

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DON'T TRY to drive nails all the way with hammer alone or it will damage tongue. Use nail set on last ¼", and countersink heads slightly so tongue will slip easily into groove.

BOARDS ARE TAPPED into place to insure a tight, even fit. Scrap piece of paneling slips over board to be nailed and permits hammering without damaging delicate tongue.

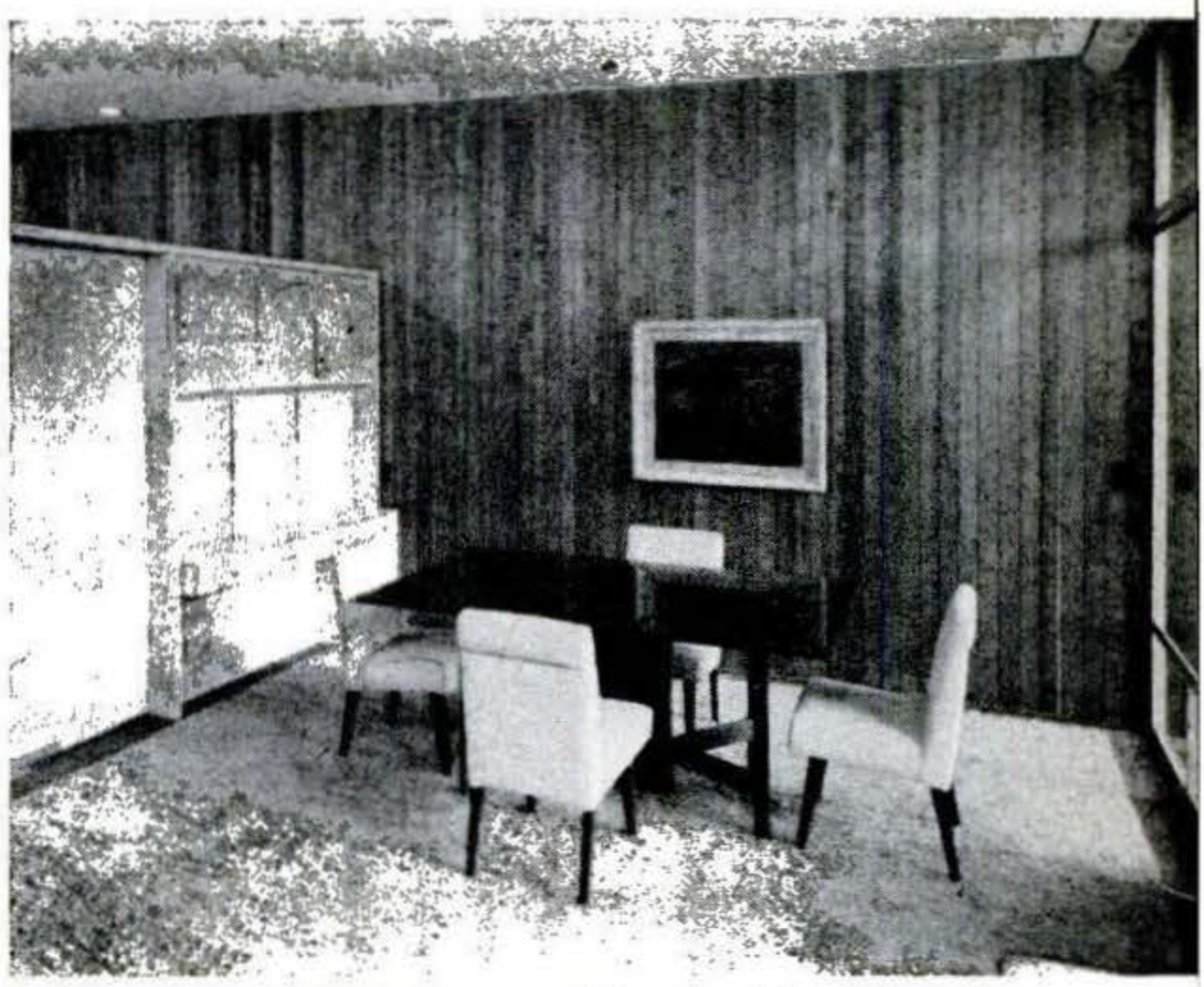
WARPED BOARDS that are hard to fit can be pried in place with this lever setup. Wrecking bar, exerted against block clamped to furring strip, holds board while it's nailed.

Finishing. Perhaps the best-looking finish for fine woods is none at all, as they mellow with age and take on their own handsome hues. But this is possible only for areas out of reach of cooking fumes, coal or other dust, dampness, and small, smudgy fingers—especially small, smudgy fingers.

Next best thing for a natural look is water-clear lacquer, brushed on in two coats. Clear wood sealers, white shellac, and flat varnish also give natural finishes.

For results lighter in color than the natural wood, a white-pigment sealer can be used. This is brushed on, allowed to penetrate for a few minutes, then gently wiped with a soft cloth. A little raw umber or other pigment may be added to the white sealer for a variation in tint.

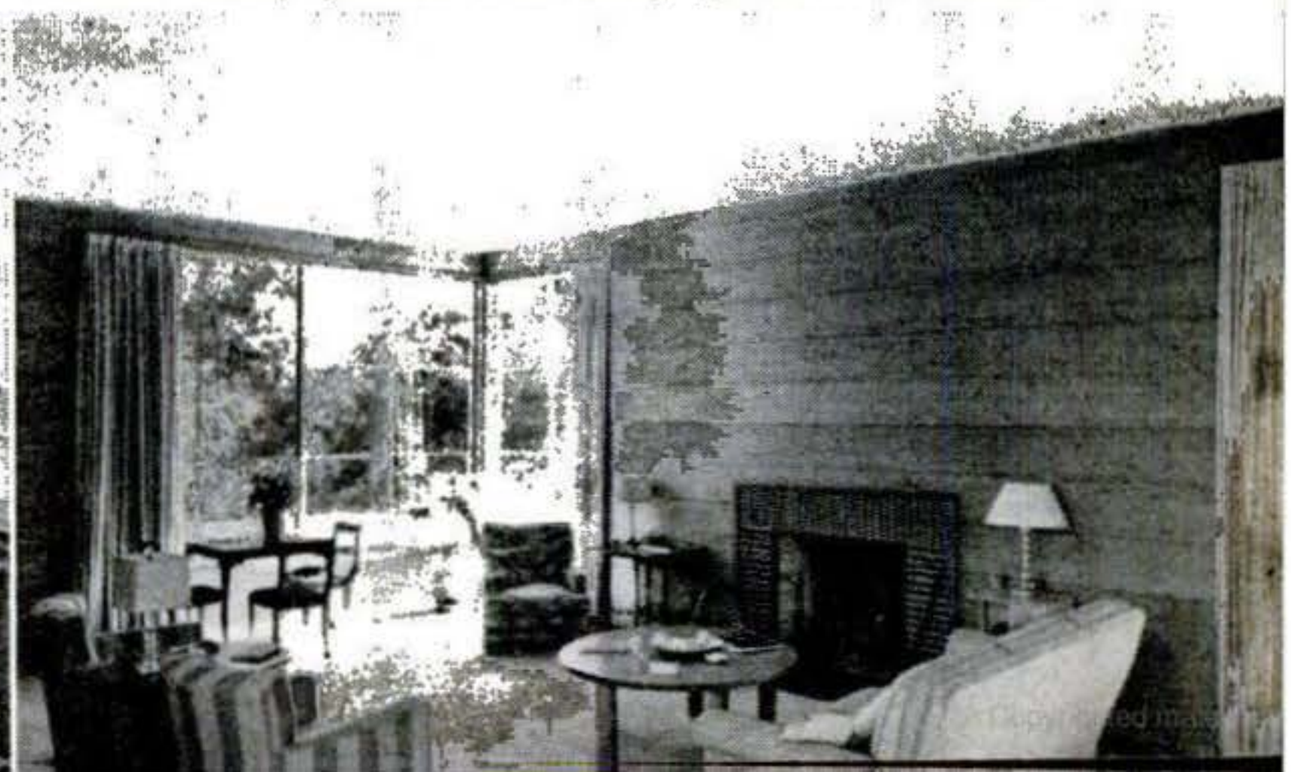
For drastic bleaching, commercial wood bleach should be used. Light bleaching can

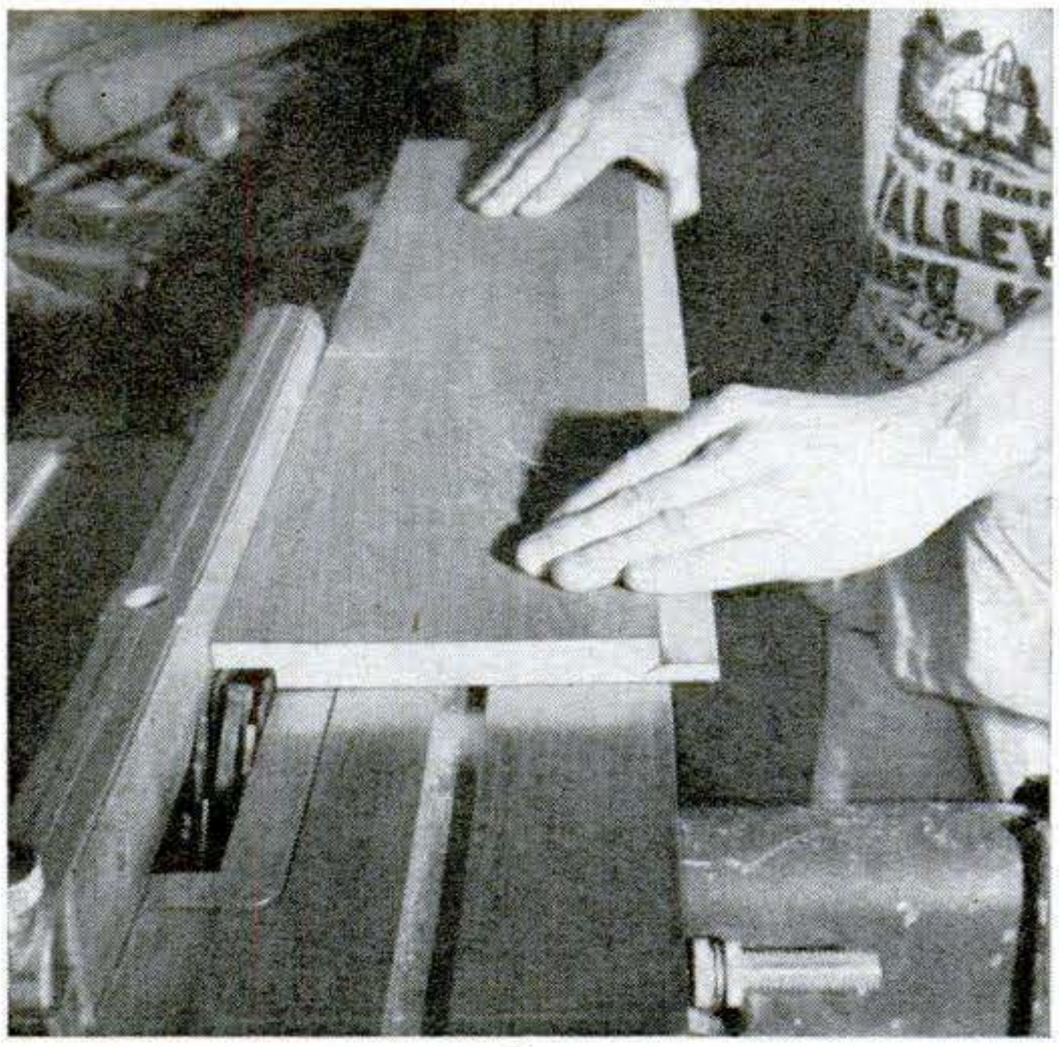


SINGLE PANELED WALL, combined with painted surfaces, creates striking effect with only a little wood. Here, absence of molding and baseboard looks modern, accentuates height.

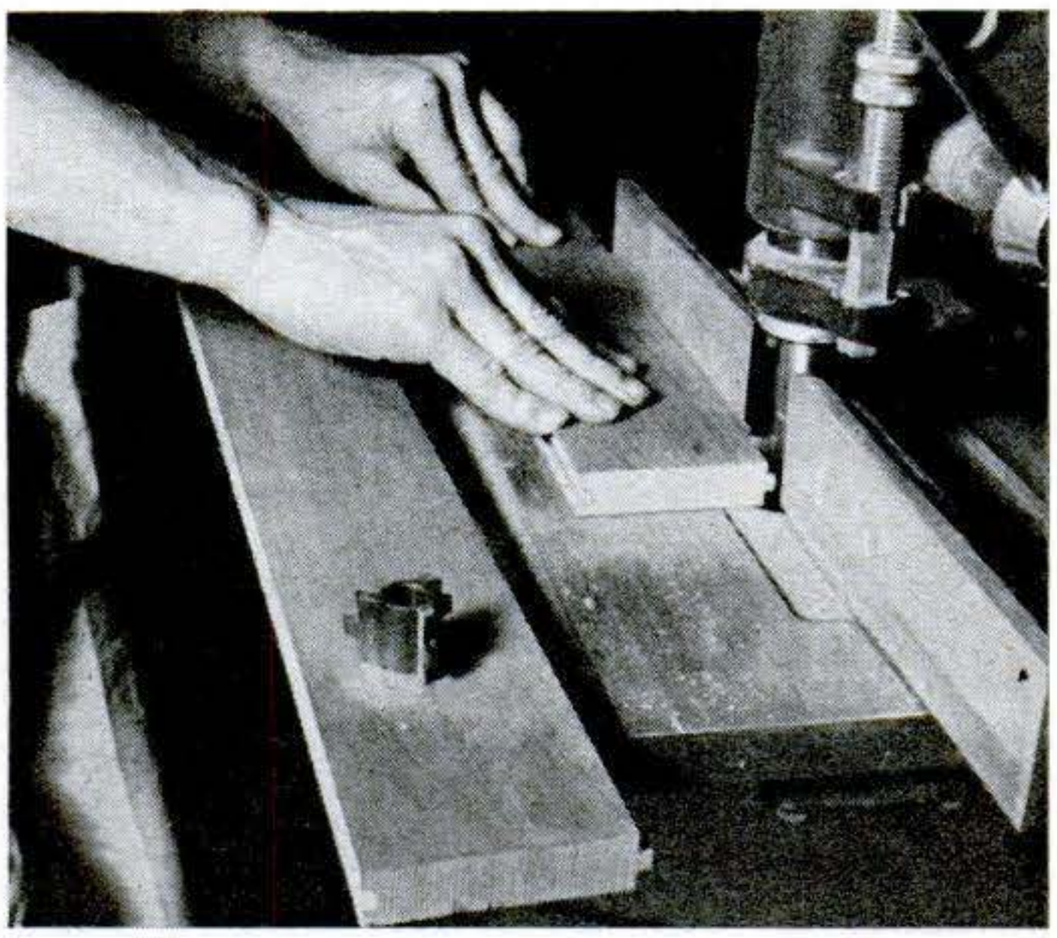
FLOOR BECOMES WALL in this unusual use of ordinary softwood flooring. Narrow t&g strips are economical, give jointless effect, but take more work because of greater nailing.

HORIZONTAL PANELING makes room look longer, is easier to put up since boards can be nailed to studs, saving furring strips. Avoid fancy joints that may give wild effect.





DADO BLADE in circular saw is easy way to make shiplap joints. Set blade about 1½" wide, rabbet one edge, then flop board over and rabbet other edge on opposite side.



SHAPER CUTTERS will quickly cut tongues and grooves on boards in single pass of blade. Edges can also be shaped on circular saw with dado blade or cutters in molding head.

be done with household bleaches—Clorox, Purex, etc. Also used to bleach is a saturated solution of oxalic-acid crystals in boiling water. Apply it hot, let dry, and remove any bloom that appears with alcohol. Then sandpaper and finish with one coat of clear lacquer, buffed lightly with fine steel wool.

You can add color. Any paint store offers a stock of standard wood stains that can be used to add color to paneling. Stain may be followed by a protective coat of shellac, lacquer or flat varnish. There are many attractive one-coat sealer stains, such as Color Rez. For color with the soft glow of wax, use Cabot's Stain Wax, which comes in a variety of soft shades.

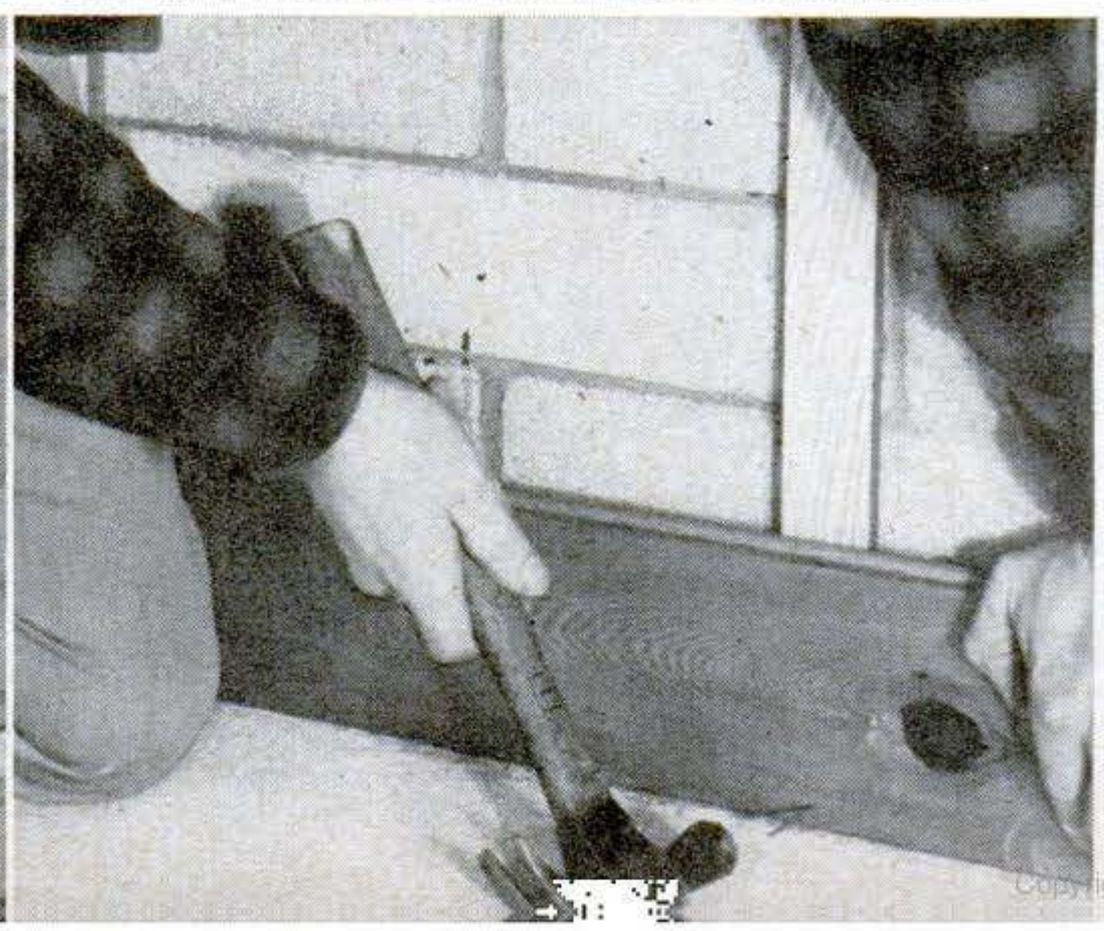
You can make up finishes in any shade you can imagine by mixing colors-in-oil with a suitable carrier. For transparent effects, mix the color with boiled linseed oil and thin with turpentine. For a softer and more opaque result—especially good if the wood has too violent a grain—mix the color with enamel undercoat and thin with linseed oil.

For finishes of this type, the color can be just about anything you like. Most usual is one of the brown pigments with just a little ultramarine blue. Protect it with white shellac, lacquer, or flat varnish, plus wax.

When to finish is almost as important as how. The general rule for any two-coat finish is to apply the first coat before putting the paneling up. This gets the finish into the joints where otherwise a streak of raw wood might show up if the boards shrink or move. It also protects the wood from finger marks during installation. The second and any other coats can then be applied after the paneling job is completed. For more suggestions on finishes, see PSM for April '53, page 212. END

ON MASONRY WALLS, furring strips can often be fastened on with ordinary nails. If not, try steel-cut nails or glue-on wall anchors. Paneling is then nailed on in the usual way.

HORIZONTAL PANELING over masonry requires vertical strips. If wall shows dampness, back-prime boards before installing. If moisture is serious, wall must be waterproofed, too.



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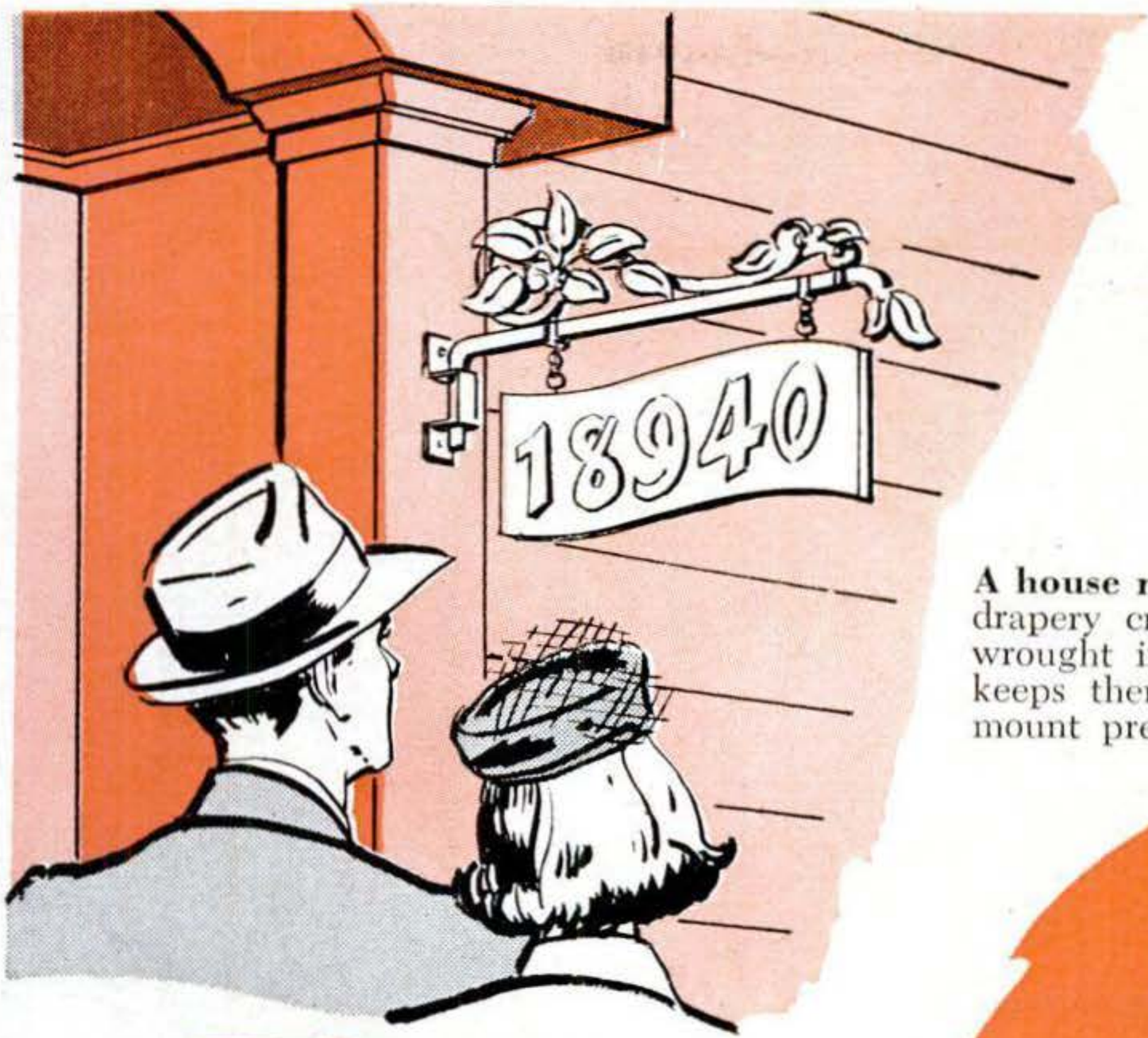
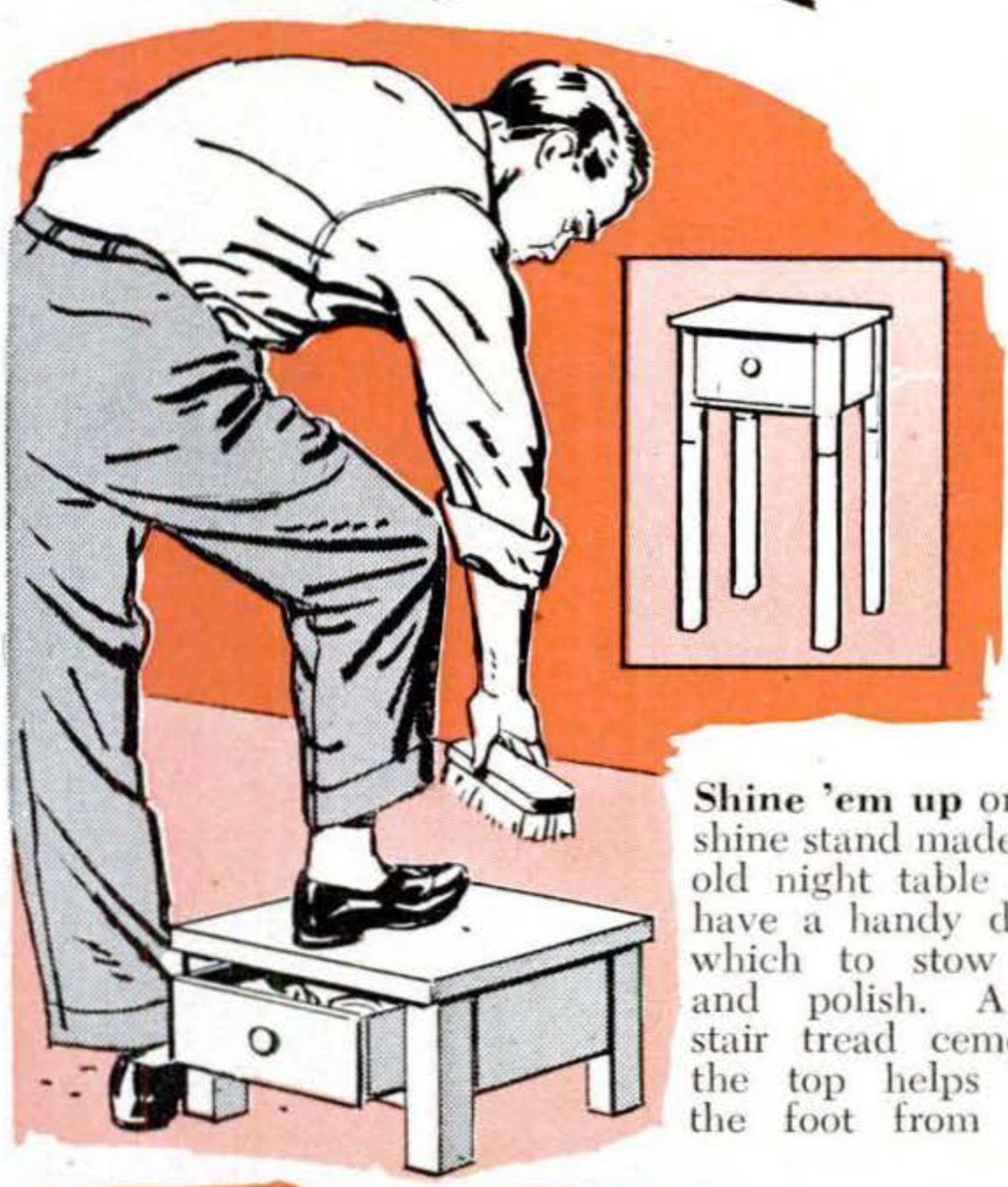
KEEPING THE *Home* SHIPSHAPE

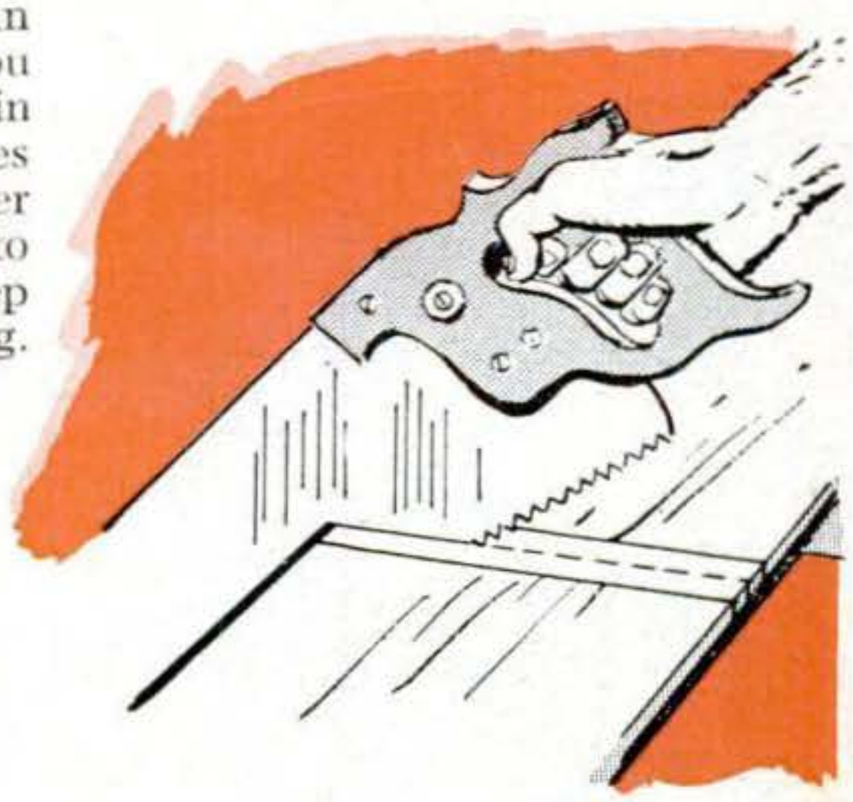


A house marker can be hung from an old drapery crane, painted black to resemble wrought iron. A screw through the arms keeps them from sliding. Another in the mount prevents the crane from swinging.

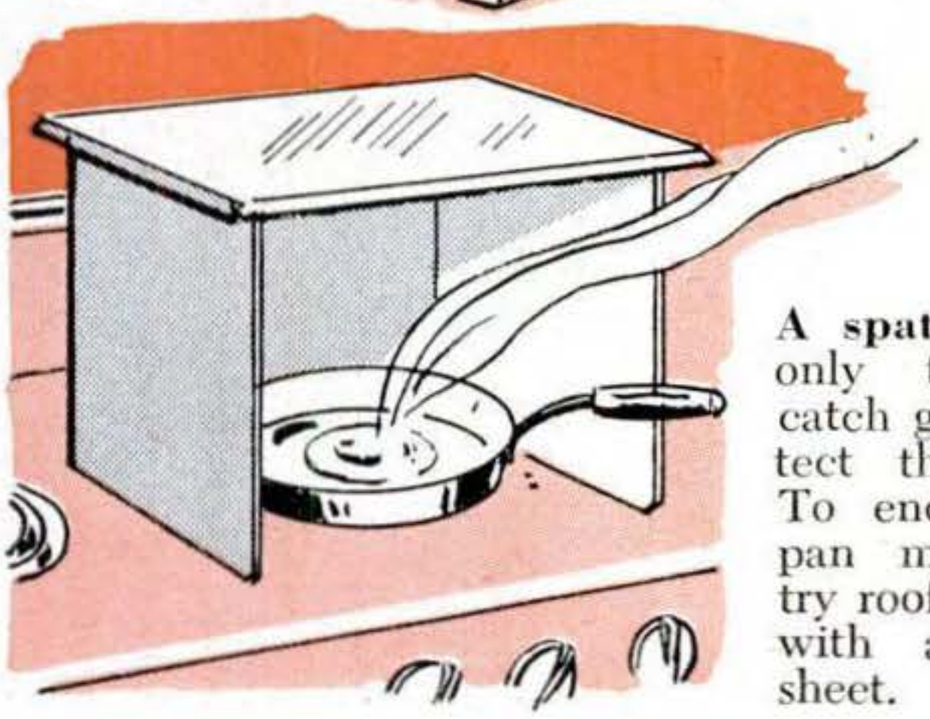
For faster ironing, reflect hea onto the underside of the work by tacking or stapling several sheets of heavy-duty aluminum foil over the padding beneath the cover.



Shine 'em up on a shoe-shine stand made from an old night table and you have a handy drawer in which to stow brushes and polish. A rubber stair tread cemented to the top helps to keep the foot from slipping.



To get a clean cut when sawing old veneered wood for re-use, paste cellulose tape over the kerf line. Held fast by the tape, the veneer is less liable to lift and splinter as the saw rides through.



A spatter shield with only three sides to catch grease won't protect the ceiling area. To enclose the frying pan more completely, try roofing in the shield with a cookie-baking sheet.

Please turn the page for more home tips.

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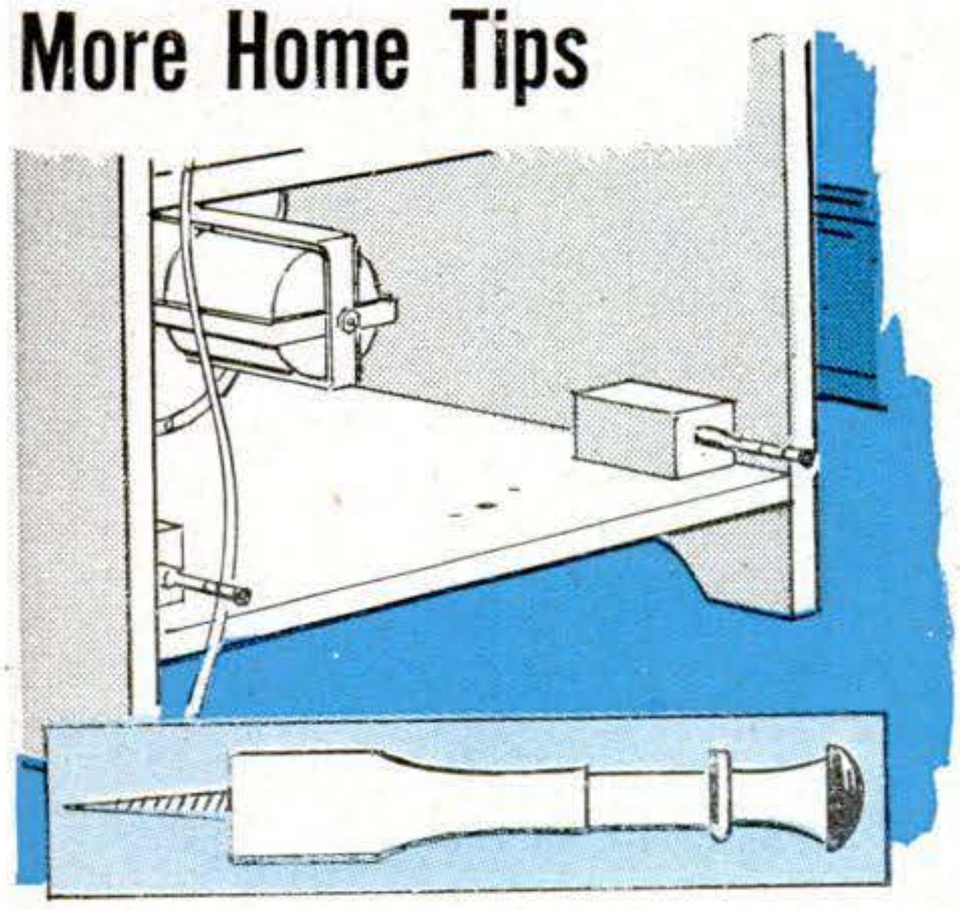
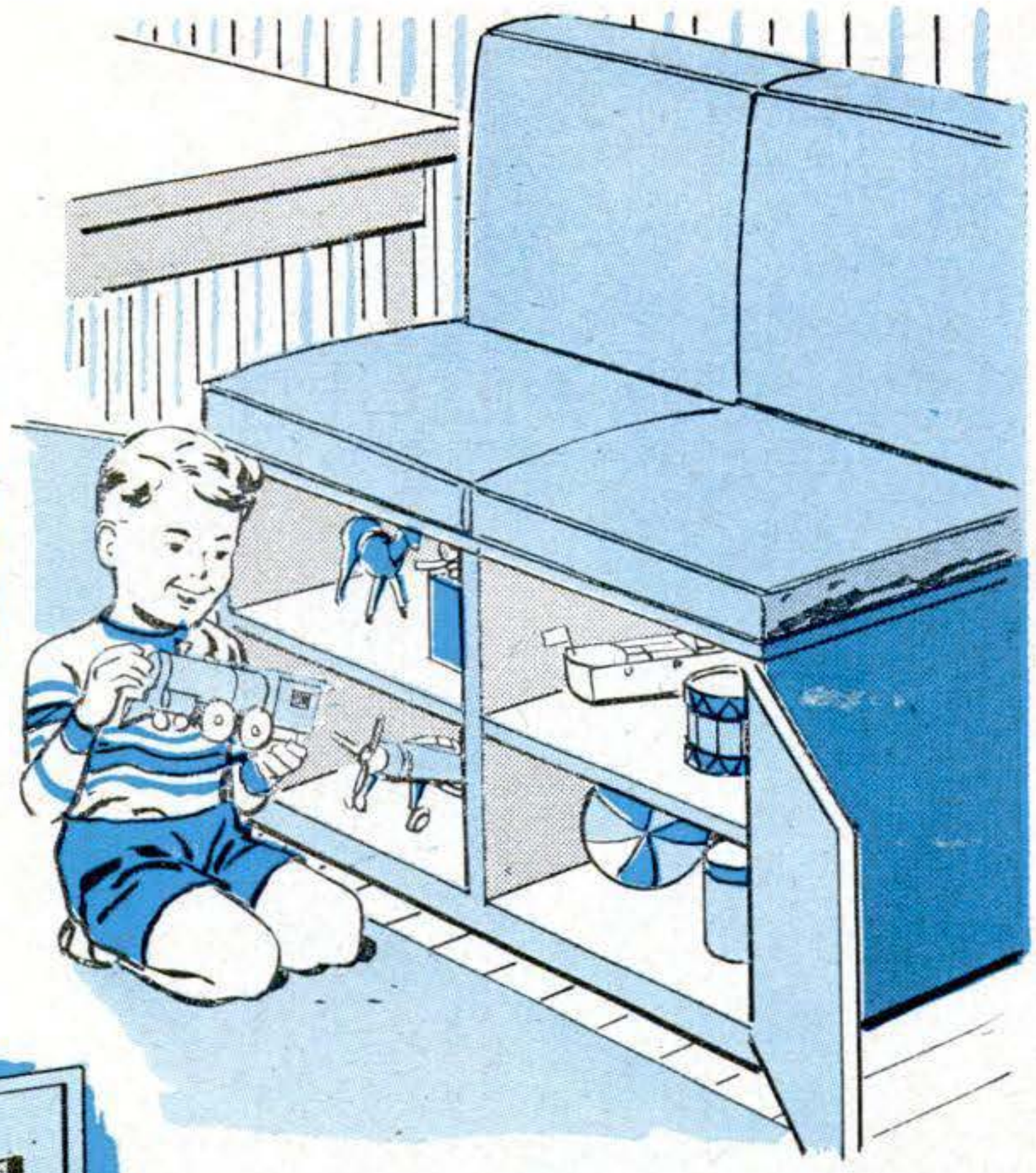
More Home Tips



To give TV wires clearance on the floor, mount rubber-tipped door bumpers on blocks at the rear of the cabinet to prevent it from being shoved up tight against the baseboard.



A seat with storage space beneath is easily made by setting a kitchen wall cabinet on a framework of one-by-twos and upholstering the top. If the door handles are near the floor, invert the cabinet.

Spice shelves on swinging doors need high aprons to keep the boxes from tumbling out. Wide strips of clear plastic will do the job without blocking out the labels.

A hammer holster hanging from your belt will keep the tool in reach when you're doing carpentry jobs. One like this can be bent from a 24″ piece of No. 9 steel wire, or from a stiff coat hanger. Form a wire rectangle about 1¼″ by 2″ in size to hold the hammer head.

To re-cover chair arms without redoing the whole chair, swipe the fabric from the underside of the seat cushion or the rear of the chair back where a replacement of new, but blending, material will be less conspicuous.

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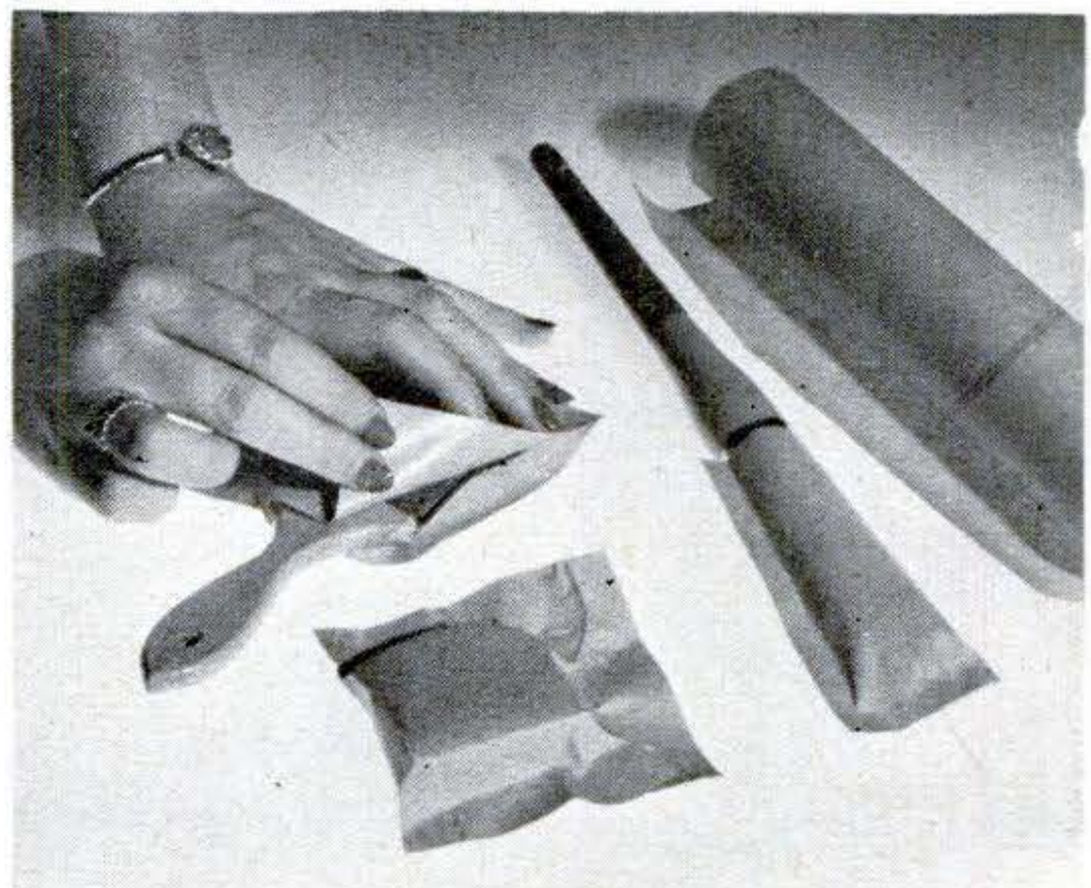
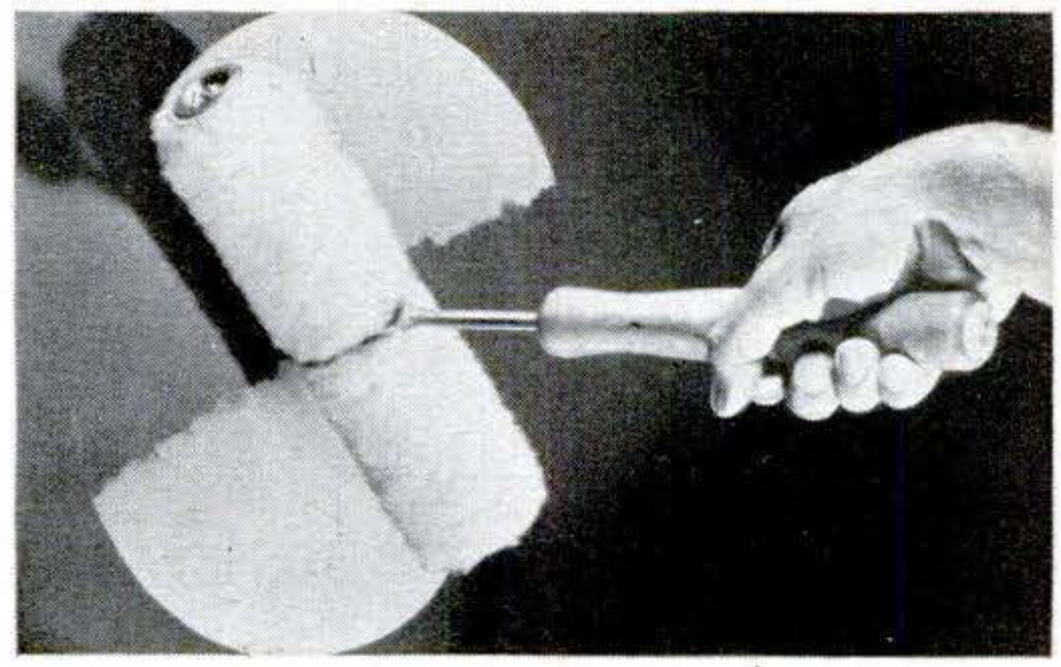
New for the Handy-Man Painter



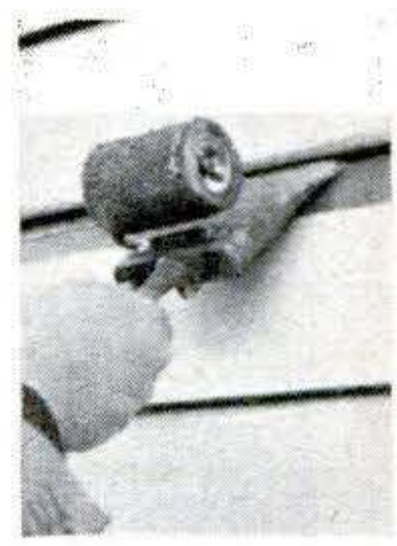
1. Self-Sealing Paper Preserves Brushes. It's a snap to seal up a clean brush with a new kind of paper. It is coated with latex, which sticks only to itself. You just wrap up the brush and press the edges of the sheet together. The paper is also useful for storing small parts, and for protecting precision tools in the process of shipment.

2. Two-Headed Tool Cleans Rollers. The sickle-shaped scraper on this new tool strips the paint from a roller; the other end is used to brush the paint out of the fibers. Since the bristles of the brush are nylon, which doesn't soften in water, it is said to be especially effective in the removal of water-thinned paints.



3. Balanced Roller Has T Head. The handle of this new paint roller divides the head into halves that rotate separately. This, says the maker, minimizes roller skid, spreads paint evenly, and provides better balance and uniform cover wear. Built for professional painters, the roller comes in 8″, 11″ and 14″ widths.

4. Pistol Grip Holds Can and Brush. You can hold paint can and brush with one hand with this new holder. The pistol grip fastens to the can with a steel band, while a clip holds the brush out of the paint.



5. Roller Clips to Brush. Combining paintbrush and roller, as this clip-on roller permits, makes an exterior job go faster. The brush is dipped into the paint as usual, but instead of excess paint being squeezed off into the bucket, it is brushed directly on, then rolled out to normal thickness. The roller is reversible, as shown, to allow painting clapboard edges or trim with brush alone. It can be clamped on any 3″, 3½″ or 4″ brush.

Further information on these products can be obtained from: 1. Sherman Paper Products Corp., 1480 Oak St., Newton Upper Falls 64, Mass.; 2. Wisconsin Laboratories, Inc., Dousman, Wis.; 3. Fond Du Lac Roller Corp., Fond Du Lac, Wis.; 4. Whizzer Products Co., 350 S. Sanford St., Pontiac, Mich.; 5. Superior Painter Tools, Inc., Fond Du Lac, Wis.

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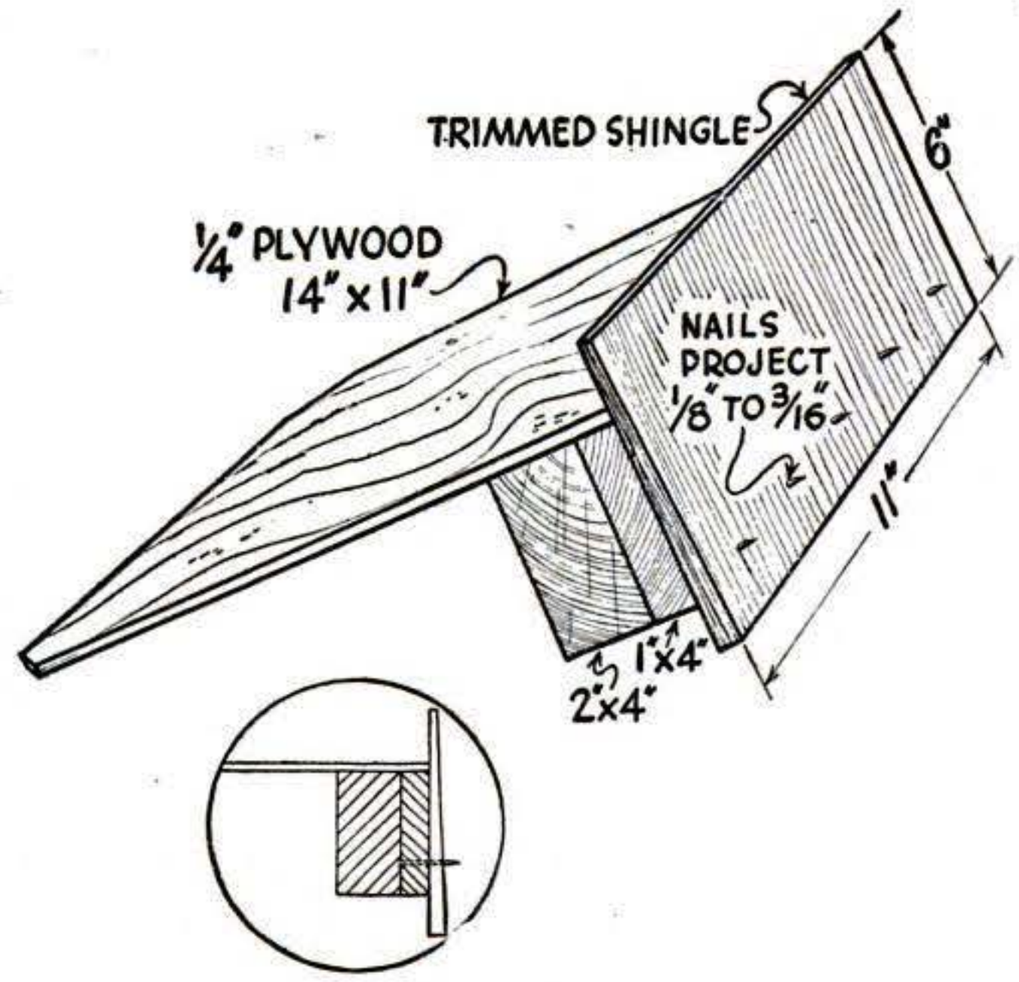
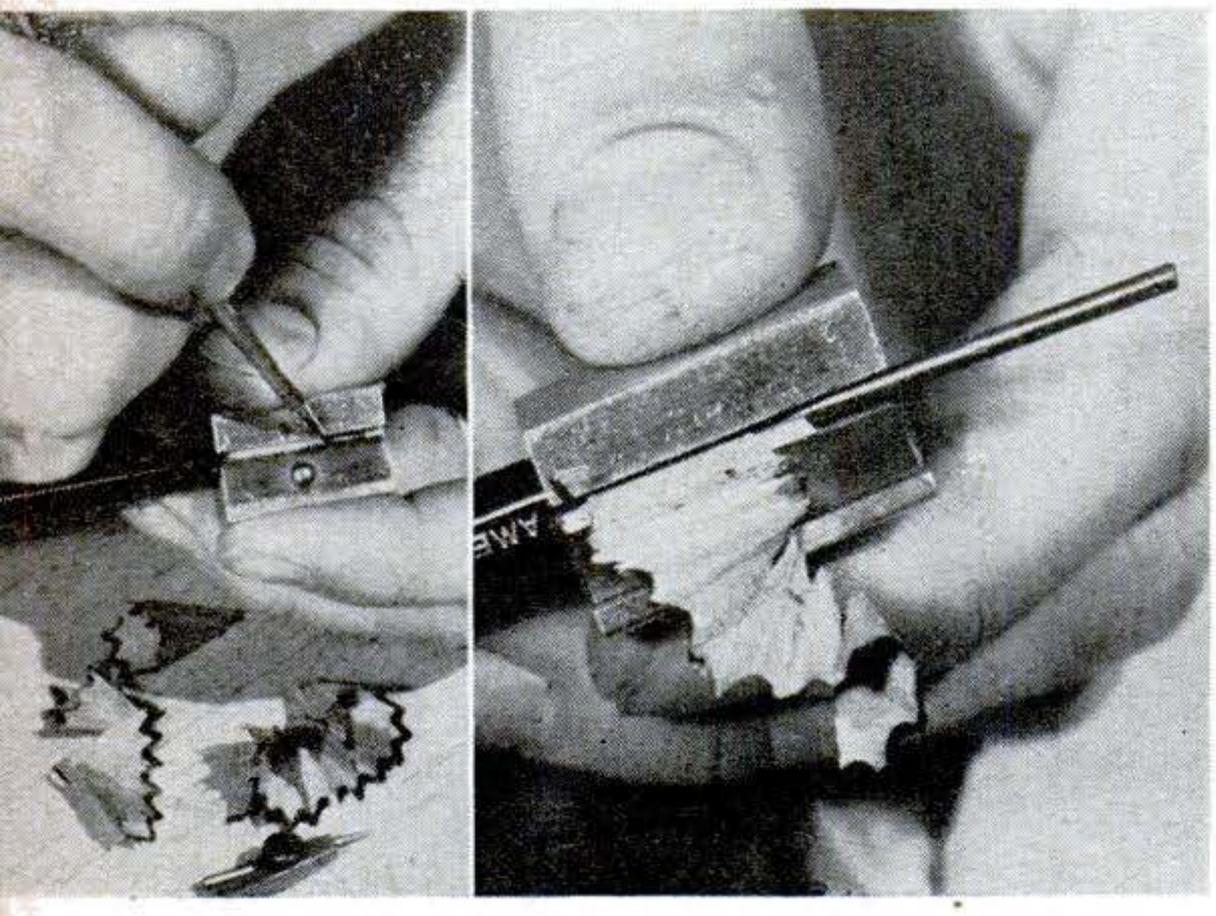


Push-On Shelf Holds Your Shingles Within Easy Reach

THIS easily made shelf keeps shingles right at your elbow as you work—and you can move it along the house wall with you. The top edge of the shelf base fits up under the overhanging "lip" of the top course of shingles on a double-coursed wall. The bottom is held by several projecting nail points that are pushed into the wood.



Sharpener Cuts Long Points

A SHARPENER for putting long points on drafting pencils can be made from the ordinary pocket type. Put a conventionally sharpened pencil into the cutter and mark the blade where lead meets wood (left above). Then file away the blade edge to the mark. The blade then shaves only the wood: the lead passes through for as long a point as wanted (right above).—*John and Ro Capotosto, Long Island City, N. Y.*

Empty Tubes Sink Fishlines

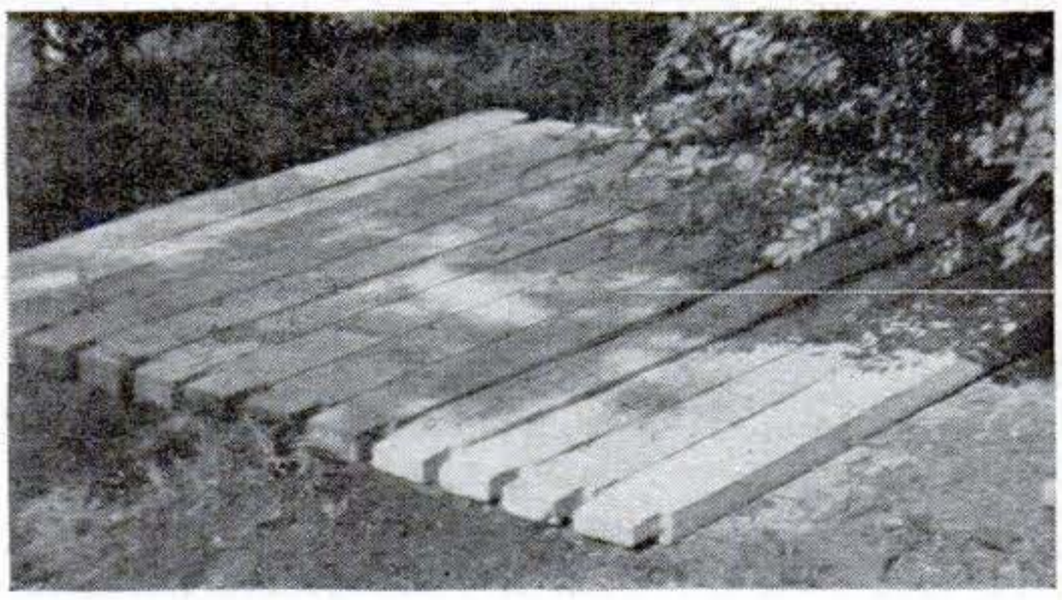
USED-UP tooth-paste and shaving-cream tubes are a good source of wrap-around sinkers for fishermen. Cut 'em up with scissors.—*Harry Allison, Jackson, Mich.*

Use Pliers to Groove Dowels

To MAKE glue-escape grooves in a dowel, just squeeze it within the large jaw opening of slip-joint pliers. If several squeezes are needed, make sure the grooves line up.—*Louis La Rue, Seattle, Wash.*

Strip-Slab Cover Lifts Easily

A PIT or cesspool cover made of narrow strips of reinforced concrete can be easily lifted off piecemeal. The 7′ slabs shown are 3½″ by 6″ in section. Each is strengthened by three full-length ⅜″ steel rods. The slabs are covered with topsoil planted to grass. Only one strip need be cleared and lifted off to inspect the pit.—*Russel S. Dart, Middle Haddam, Conn.*



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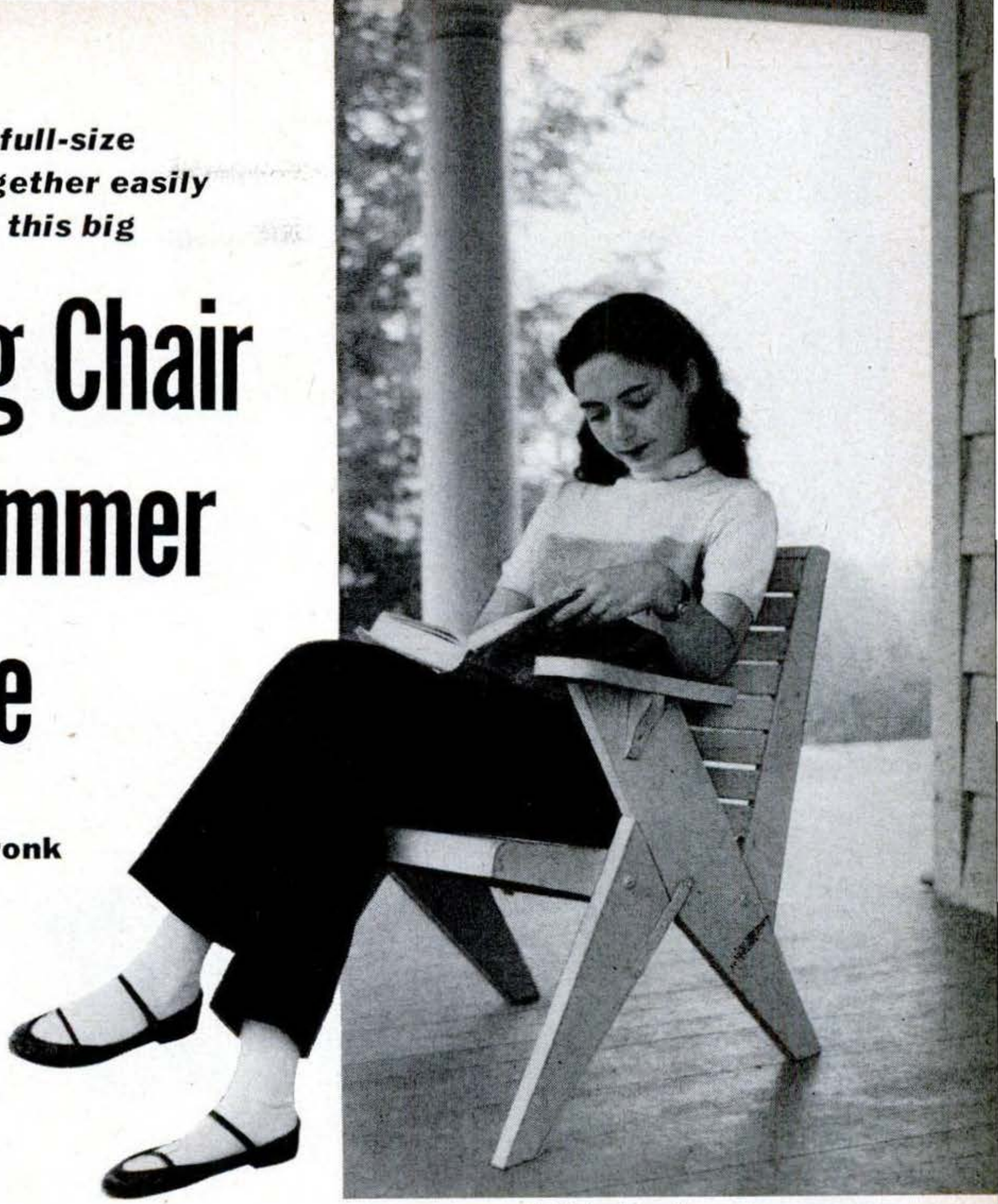
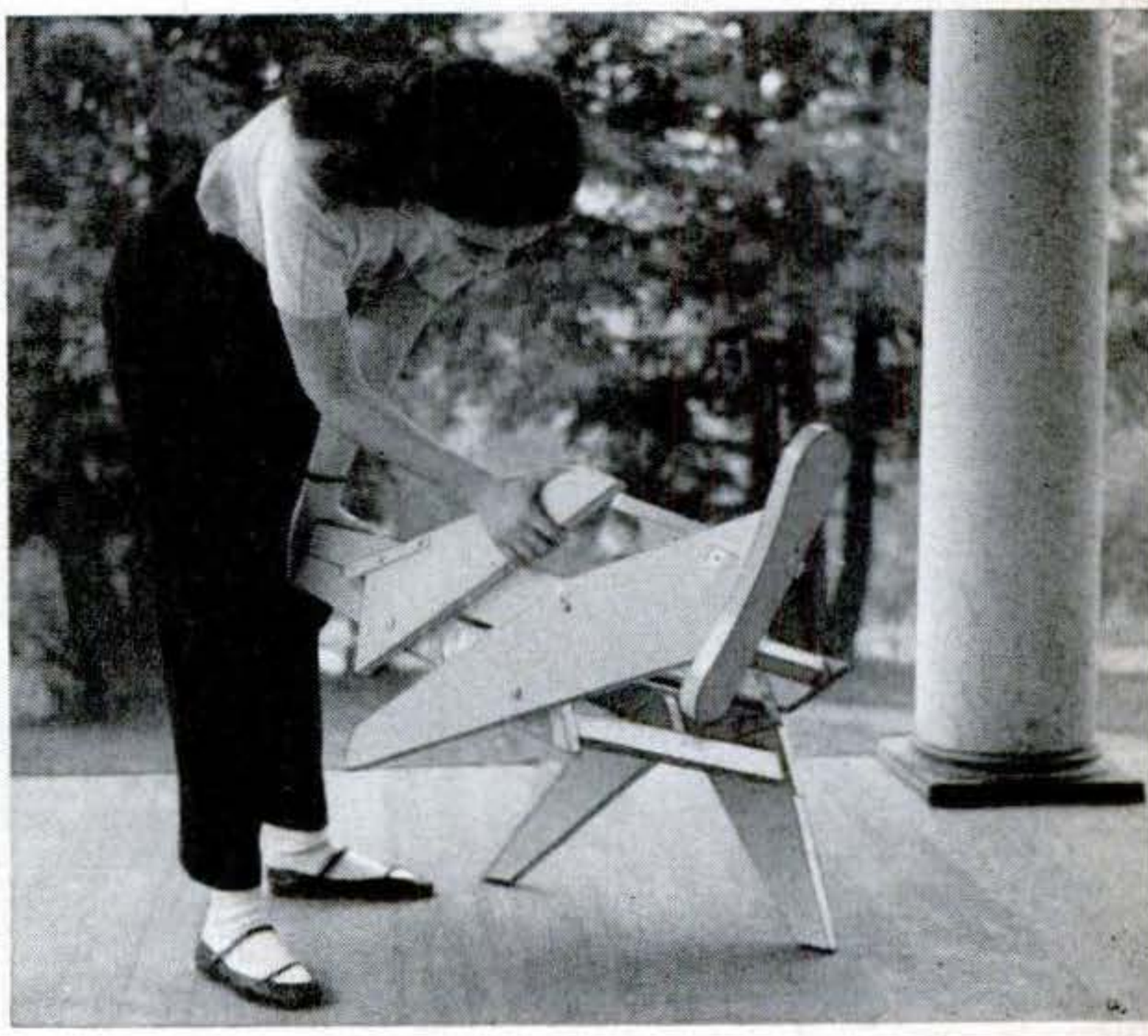
Parts cut from full-size patterns go together easily when you build this big

Folding Chair for Summer Leisure

By Leonard Cronk



LEGS PIVOT on ¼″ bolts when wing nuts are loosened. The back folds down on the seat.



INVEST a few of the remaining winter days in building this sturdy outdoor chair. Make a couple while you're at it; the investment will pay off this summer in really comfortable relaxation for you and your family.

Unlike the ordinary folding chair, this one is roomy and solid enough to lounge in for hours. Yet when weather threatens, it can be quickly folded flat and stored in a small space. When left outdoors, the back alone can be folded down to keep dust off the seat.

To make full-size patterns, rule a large sheet of heavy paper into 1″ squares. On this, draw the parts shown in the drawing on a following page.

Cut all parts except the slats from 1″ clear pine (about ¾″ actual) or ¾″ plywood. Cut a ⅜″ rabbet for the slats along one in-

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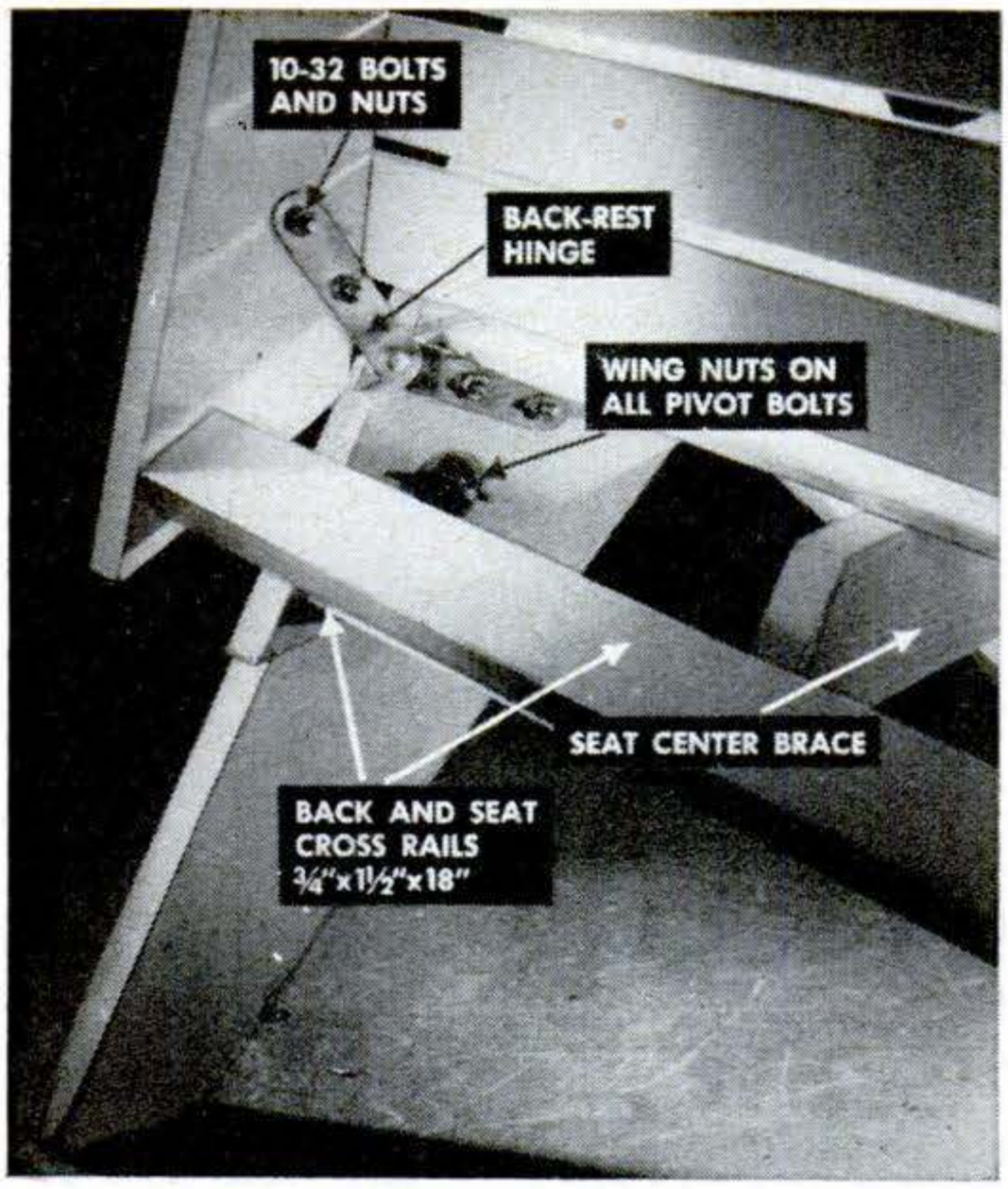


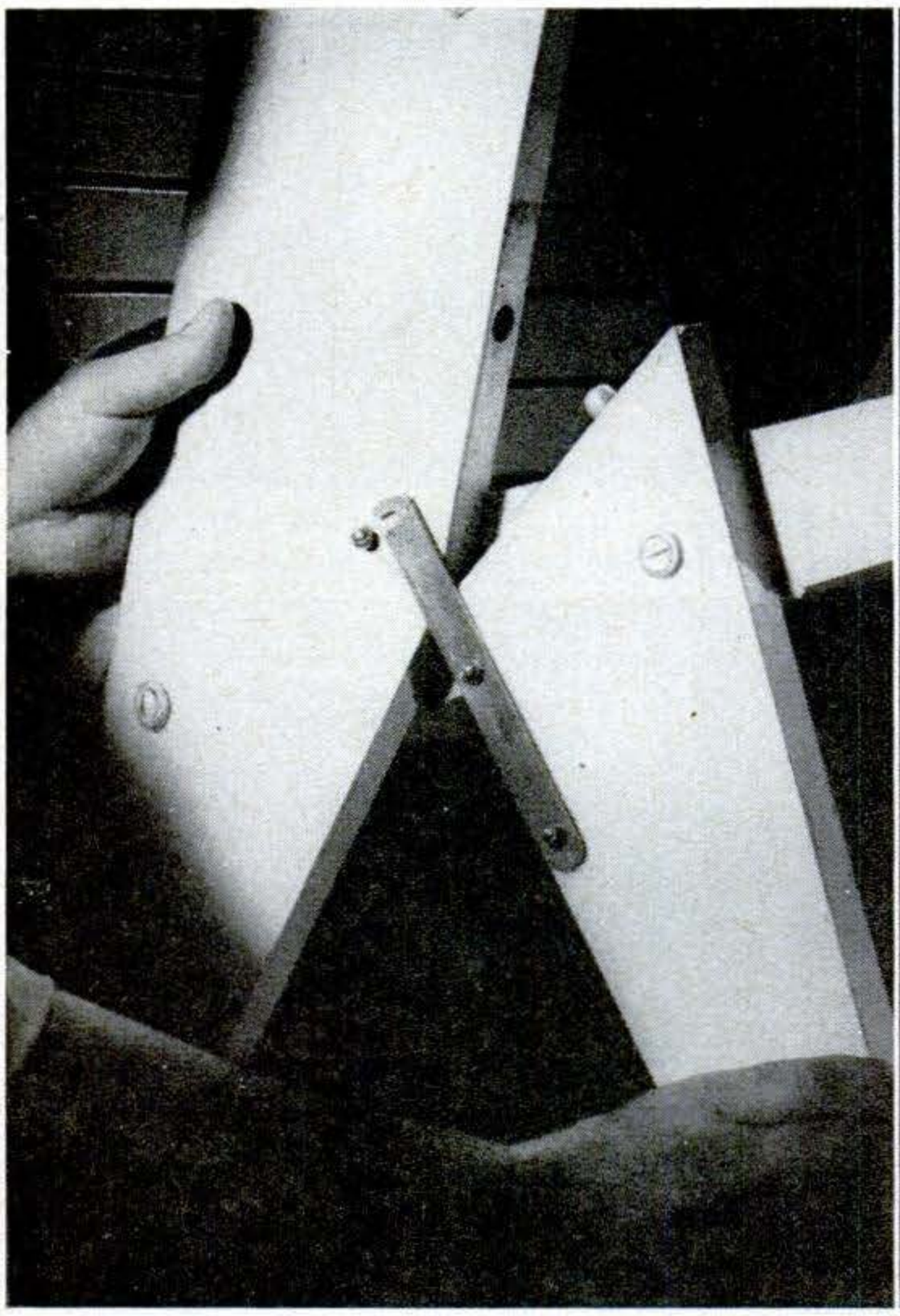
HINGES, made from 1/16" brass, join back rest to seat. Because of strain on hinges, they are bolted to side rails instead of screwed. Above, chair is partly folded to show hinge.

side edge of the side rails of the seat and back rest. Also cut a rabbet in the tapered end of these pieces for the front seat rail and top back-rest rail. Cut slats from ⅜" pine or plywood and screw them in place with oval-head brass wood screws.

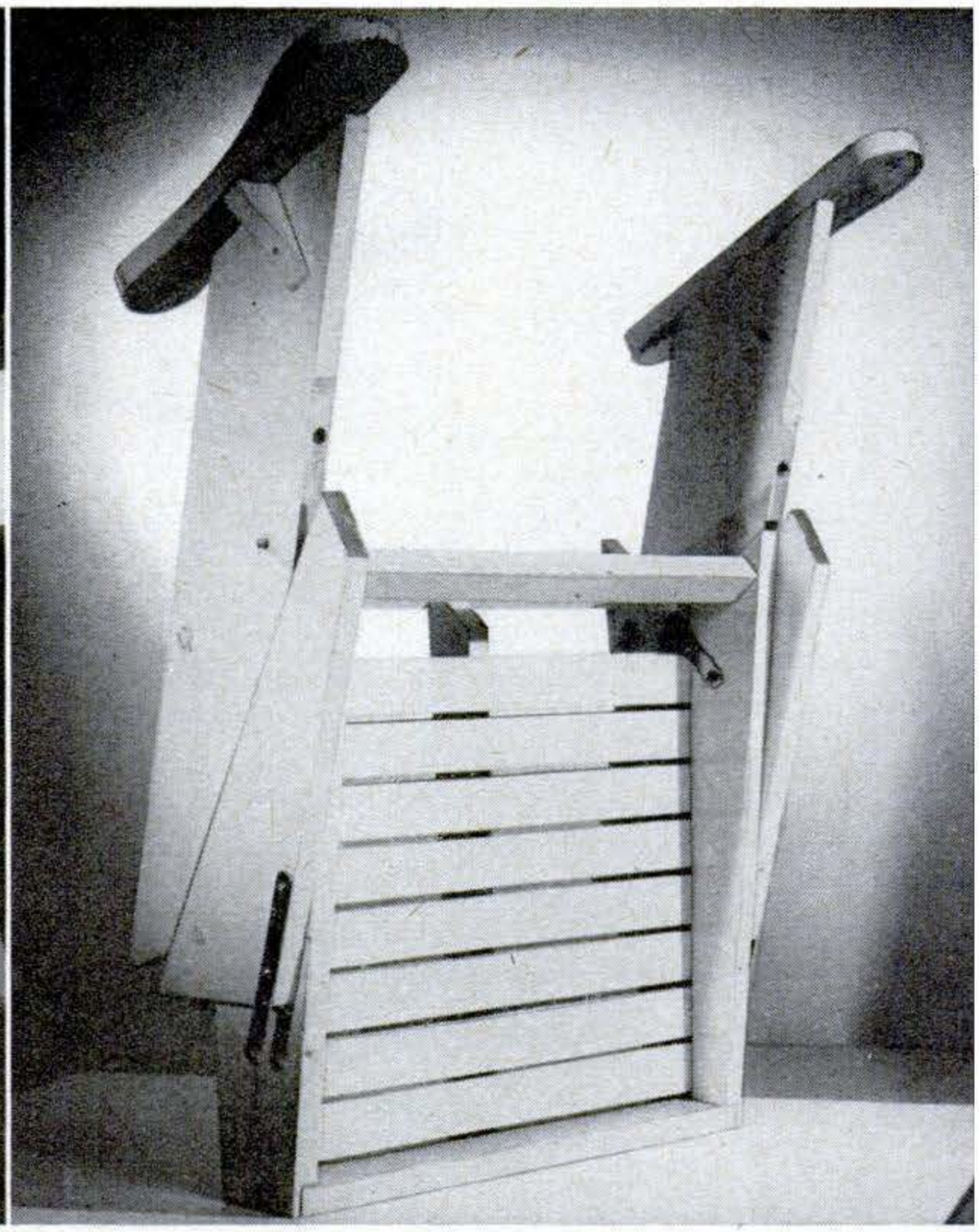
Drill ¼" pivot holes in the legs and mount them on the seat to check alignment and fit of the meeting edges. Mark the centerline of the holes for the locking dowels and remove the legs for drilling. Glue a short ½" dowel into the hole in each front leg, reassemble with wing nuts on the pivot bolts.

Screw the locking strips, cut from 1/16" brass, to the front legs and drive the catch screw part way into each back leg. Bolt the back-rest hinge, also made from 1/16" brass, to the seat and back rest while holding their beveled ends in alignment. Add the armrests and braces and sand all parts smooth.

Finish the chair natural with clear varnish, or coat with enamel over one or two coats of wood sealer or shellac. To get all parts covered, take the chair apart.



BRASS LOCKS make legs secure when chair is open. Slot engages screw driven part way into back leg. A dowel in the front leg fits into a hole in back leg to key them.



FOLDED, chair can be stored in little space. Note centerbrace under seat slats to keep them from sagging. The brace is screwed to the front and back cross rails.

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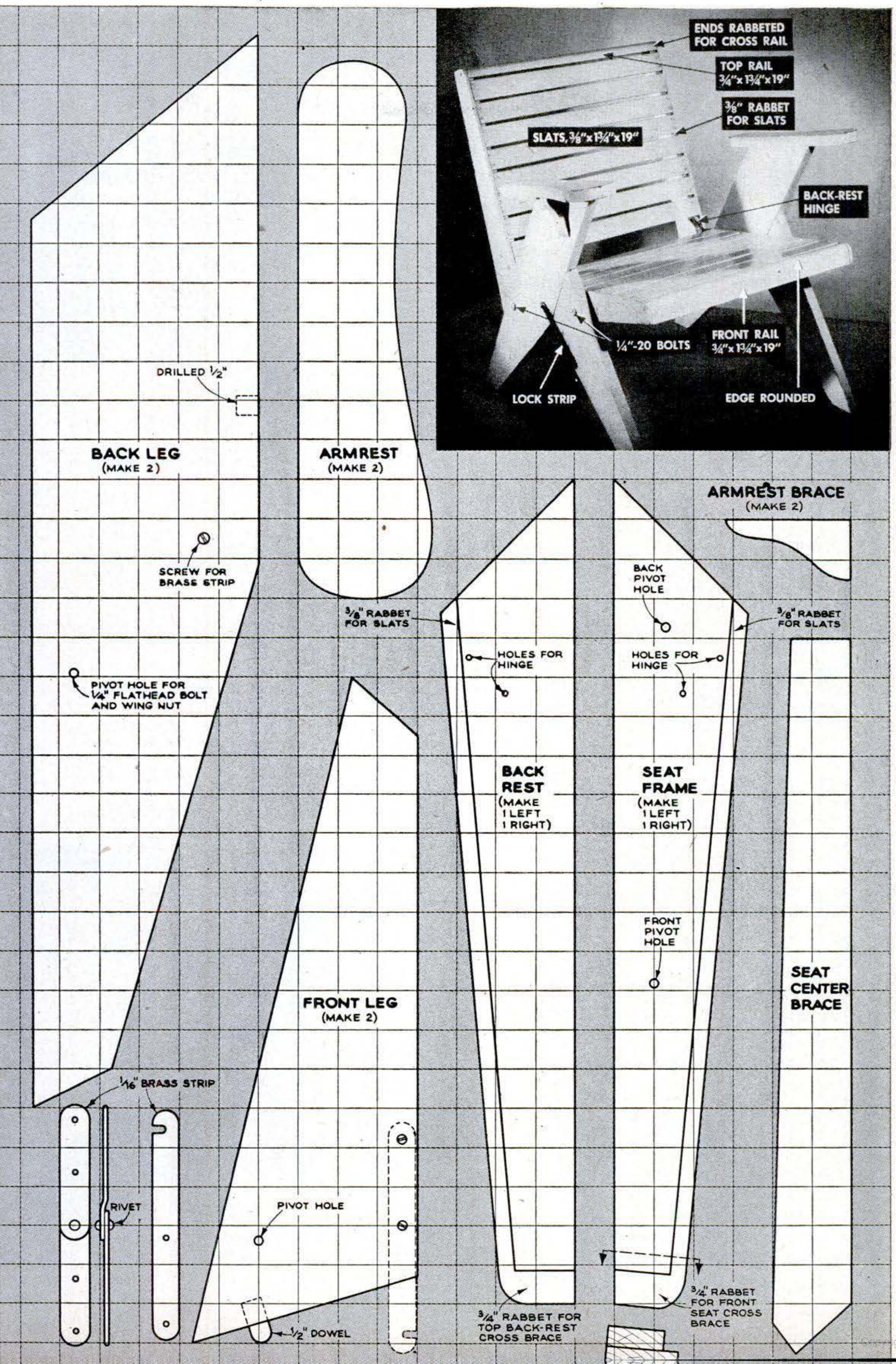
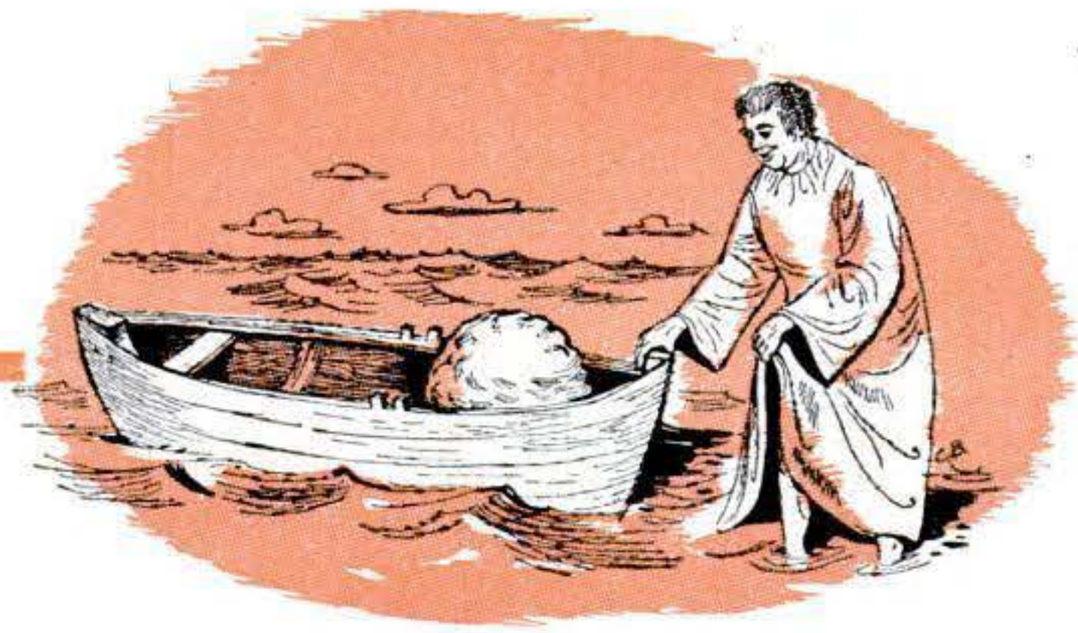

ENDS RABBETED FOR CROSS RAIL
TOP RAIL 3/4"x1 3/4"x19"
3/8" RABBET FOR SLATS
SLATS, 3/8"x1 3/4"x19"
BACK-REST HINGE
1/4"-20 BOLTS
FRONT RAIL 3/4"x1 3/4"x19"
LOCK STRIP
EDGE ROUNDED
DRILLED 1/2"
BACK LEG (MAKE 2)
ARMREST (MAKE 2)
ARMREST BRACE (MAKE 2)
SCREW FOR BRASS STRIP
3/8" RABBET FOR SLATS
BACK PIVOT HOLE
3/8" RABBET FOR SLATS
HOLES FOR HINGE
HOLES FOR HINGE
PIVOT HOLE FOR 1/4" FLATHEAD BOLT AND WING NUT
BACK REST (MAKE 1 LEFT 1 RIGHT)
SEAT FRAME (MAKE 1 LEFT 1 RIGHT)
FRONT PIVOT HOLE
SEAT CENTER BRACE
FRONT LEG (MAKE 2)
1/16" BRASS STRIP
RIVET
PIVOT HOLE
1/2" DOWEL
3/4" RABBET FOR TOP BACK-REST CROSS BRACE
3/4" RABBET FOR FRONT SEAT CROSS BRACE

How Does a Magnet Work?

Here's a good use for your old razor blades: simple tests that disclose the magnet's secrets.

SOME 700 years ago, a man named Peter was burning with curiosity—curiosity about loadstones, the queer rocks that mysteriously gripped pieces of iron that came near them. Peter fashioned a big chunk of loadstone into a globe, and set it afloat in a



rowboat. The skiff slowly swung around by itself until one particular point on the stone —Peter called it a "pole"—faced north.

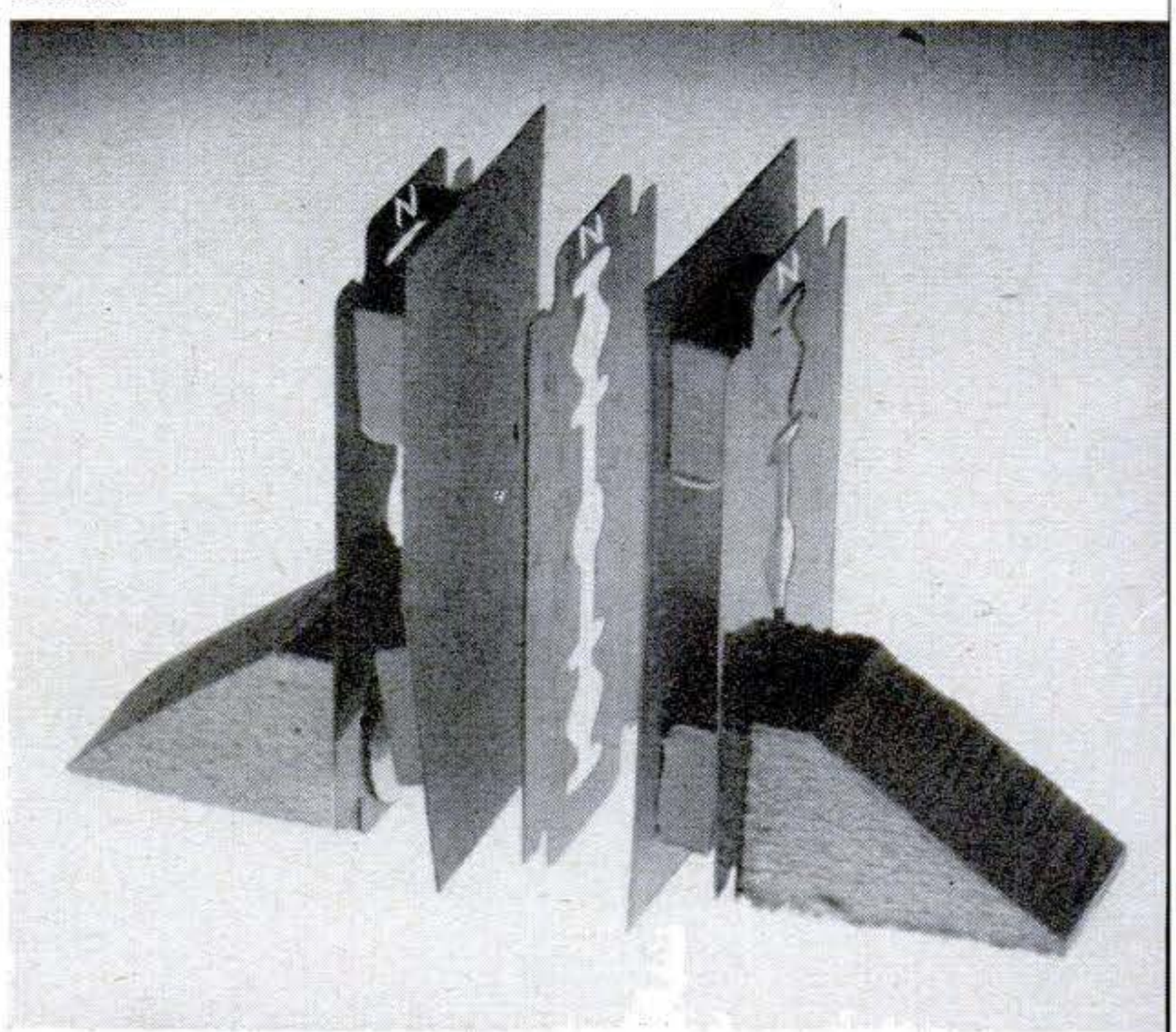
Peter gave the bow of the boat a push, swinging it around. It swung right back again. As he wrote to a friend: "If this pole were then turned away a thousand times, a thousand times would it return to its place by the will of God."

For centuries, our knowledge of the laws of magnets, which medieval scholar Peter Peregrinus explored, has paid dividends. It made the compass possible—and the discovery of America. It is the basis for the design of electric motors and generators. Without magnets, our present age of power might never have arrived.

You can learn a lot about magnets and their poles right at home. And for your experiments you don't need Peter's loadstone—just a few old razor blades. The finest hard steel, they make good magnets. (Soft steel magnetizes more easily but quickly loses its magnetic properties.)

Razor blades can easily be magnetized by holding one end against an end of either a permanent magnet or electromagnet. As shown above, an electromagnet can be made by coiling wire around a spike and connecting the ends to a battery. Start your experiment by magnetizing three razor blades. Use the same end of the magnet for all three blades and dab paint on the end of the blade that touches the magnet, so that you can identify it.

Cardboard shields are now attached to each of the two outer blades with pieces of gum or clay. (First remagnetize all blades.) Repeat the first experiment as shown above. The middle blade still stands alone, despite the shields. This shows that the cardboard permits lines of magnetic force to pass through it freely. The same experiment could be done with shields of glass, wood or paper—or any other nonmagnetic material.



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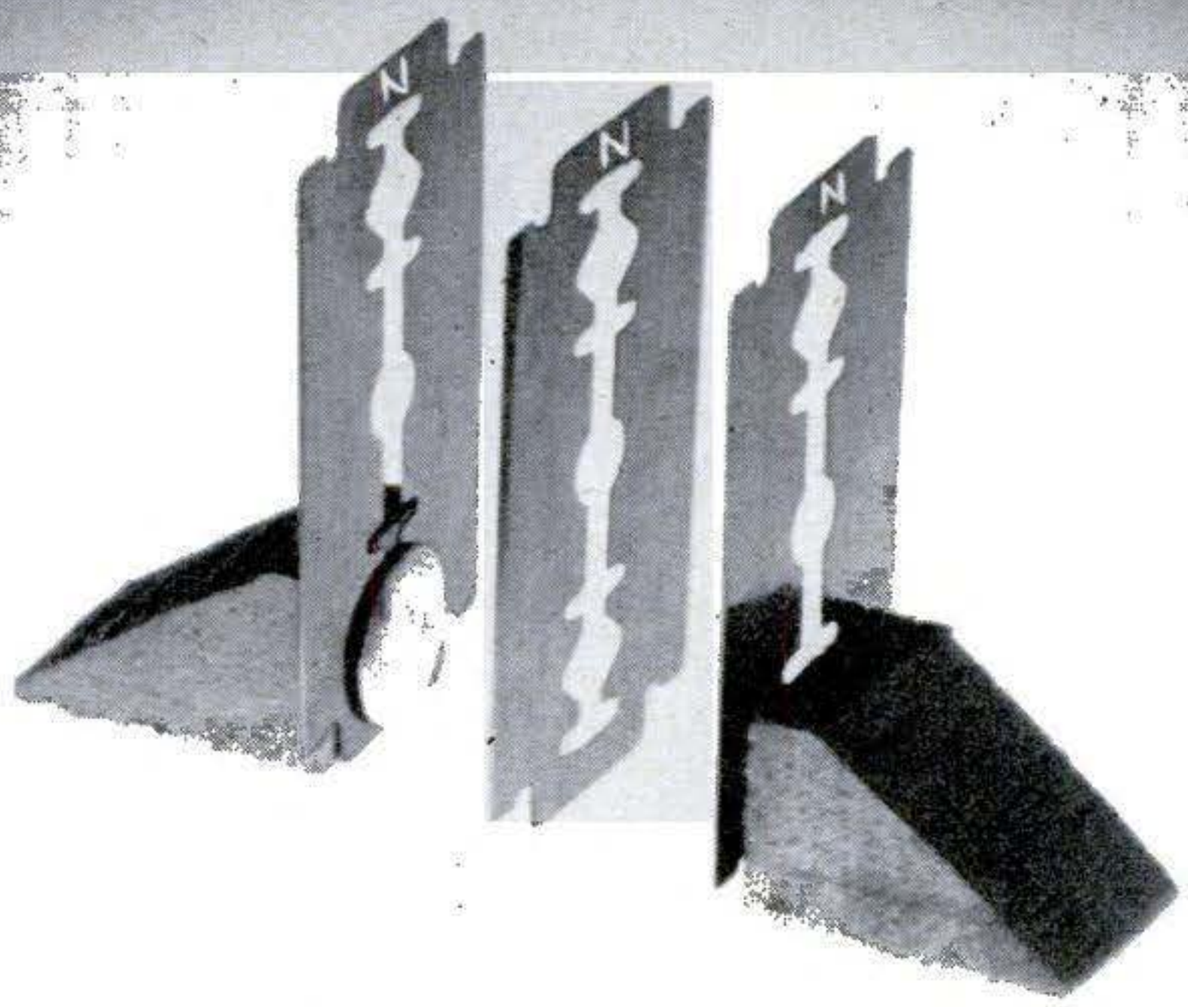
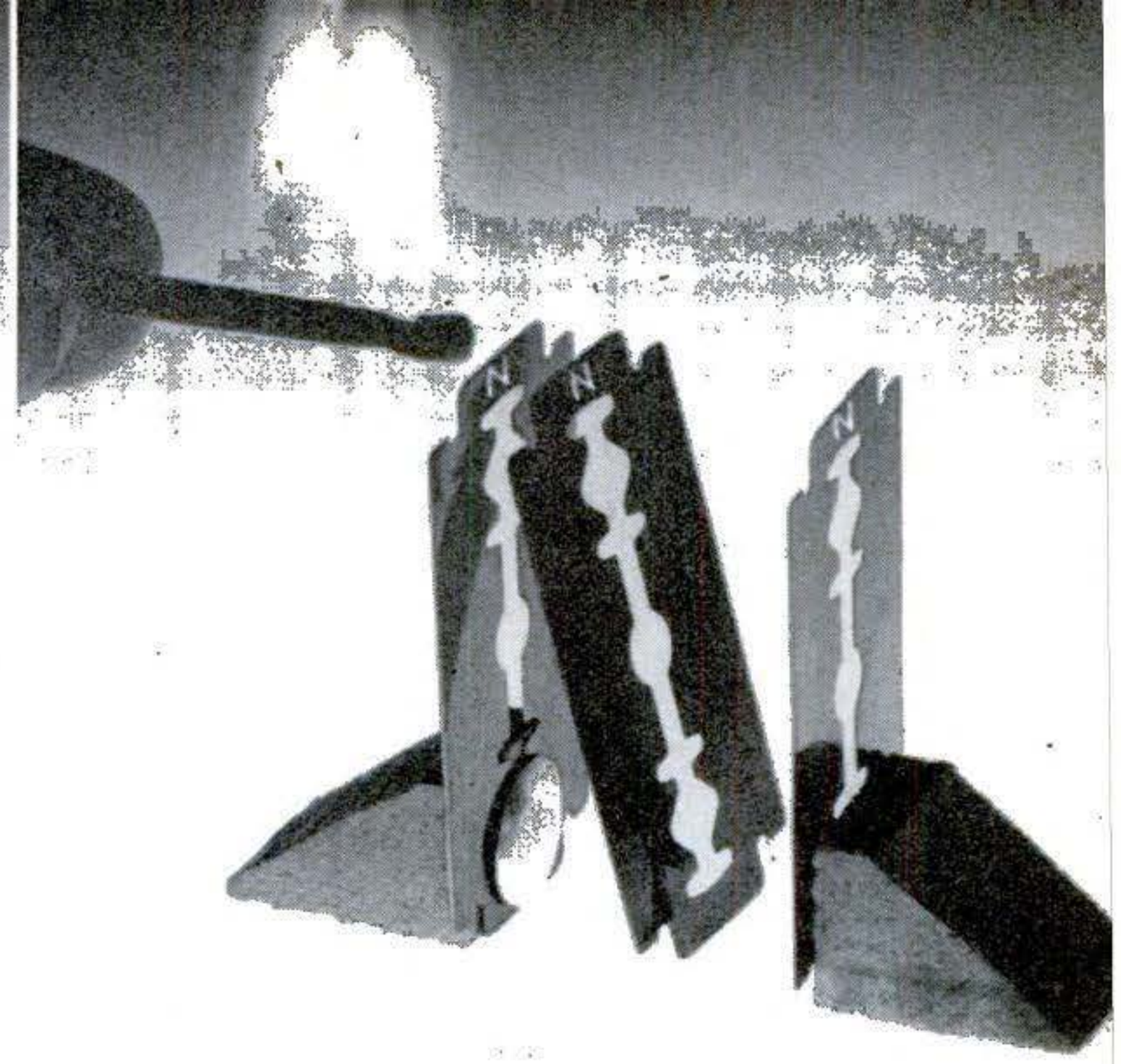




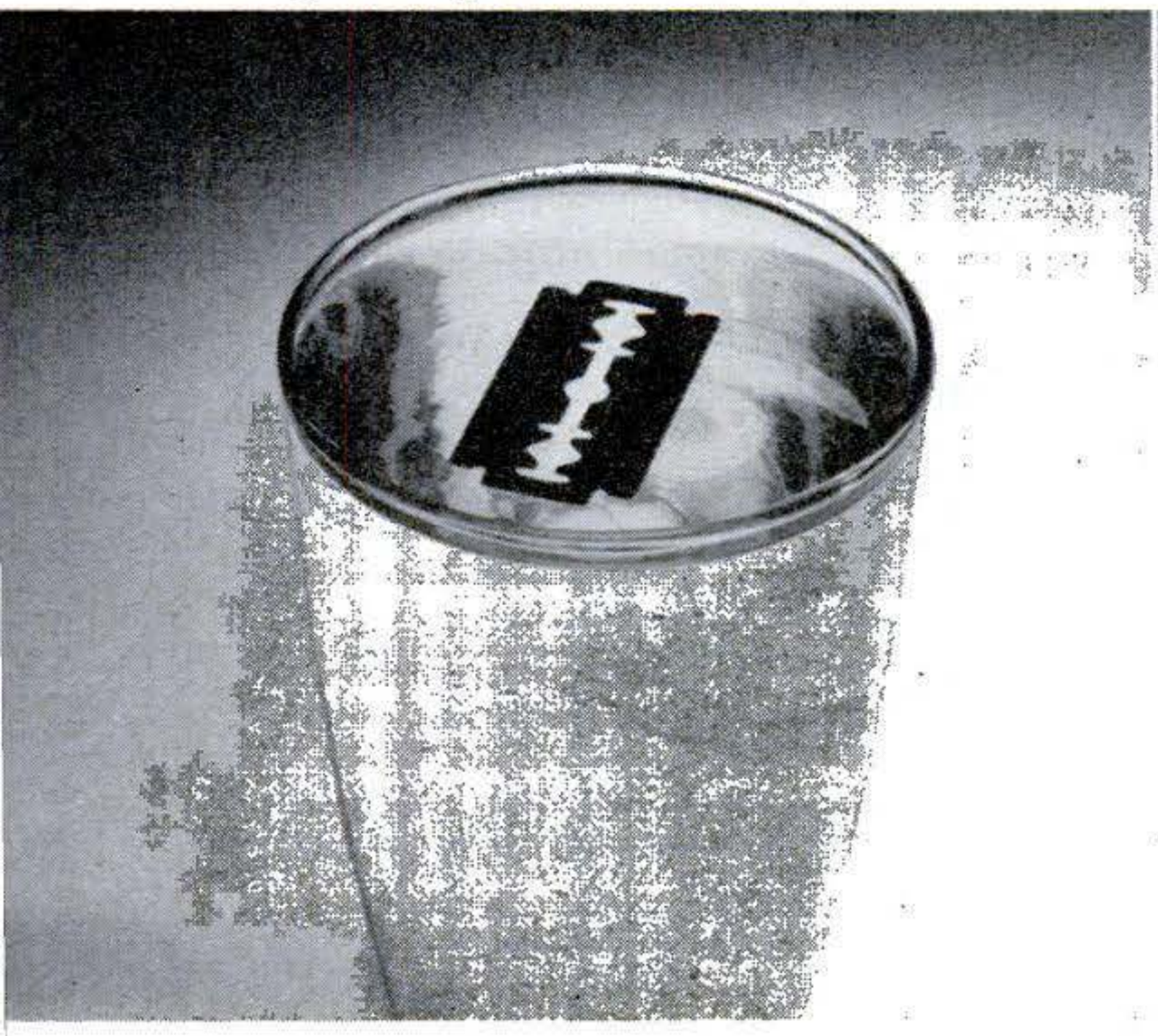
Thumbtack two of your blades to little blocks of wood. Make sure both blades have the marked ends up. These ends have become similar magnetic poles by touching the same end of the electromagnet. Stand the third blade between them, also with marked end up. It will stand unaided, merely sway if you blow gently against it. This is because similar poles repel each other, so the center blade gets an equal push from each side. (Unlike poles attract each other, as you'll find if you try the experiment after turning down the marked end of one of the outer blades.)

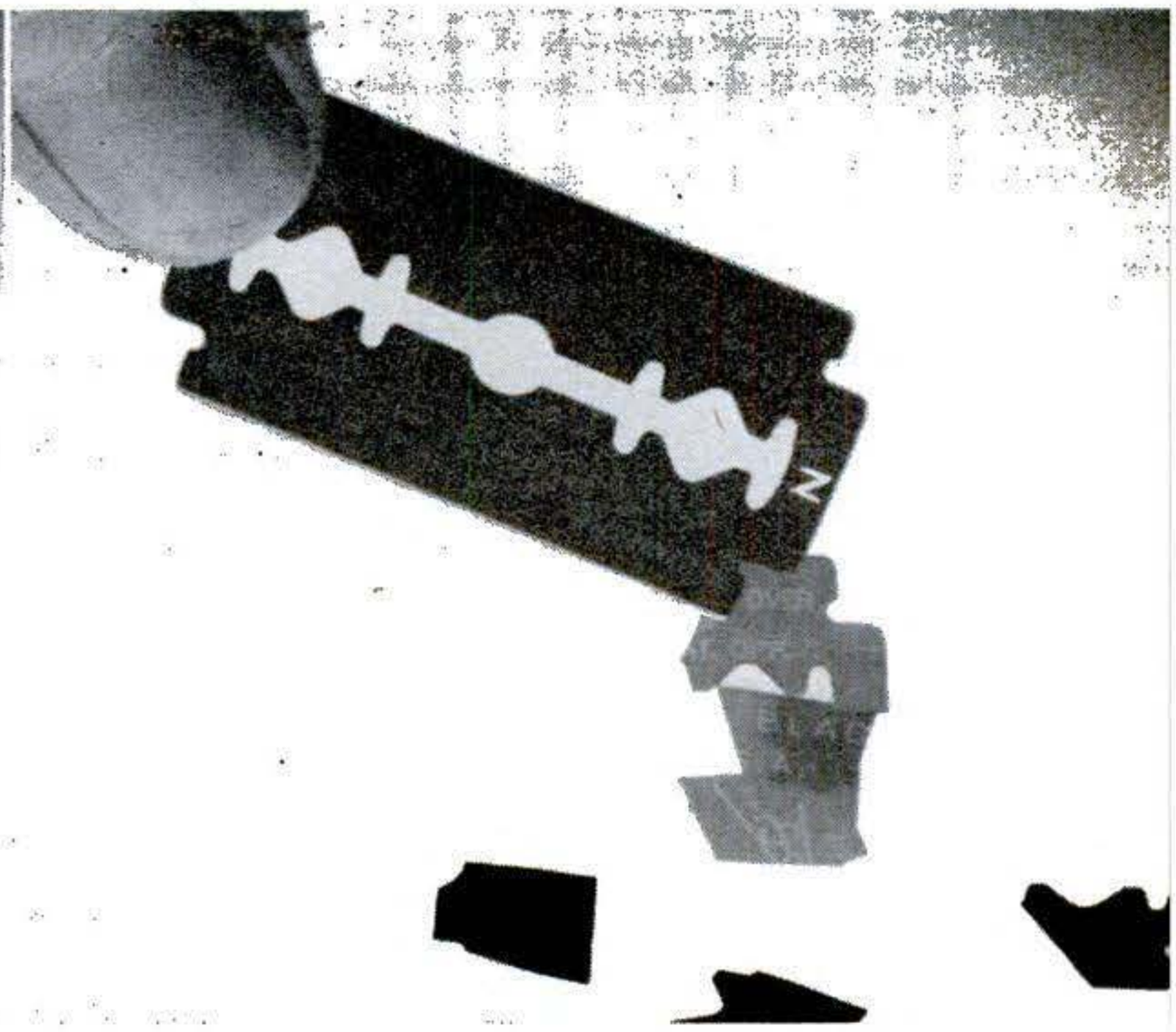
Now, as shown at the right above, bring a lighted match near one outer blade. The middle one will tip slowly toward the flame. Since heat destroys magnetism, the outer blade nearest the flame loses its power to repel the center one.

PSM PHOTOS BY ORLANDO GUERRA

Fill a glass with water and carefully slide one of your magnetized blades onto the surface. Thanks to surface tension, it will float, gradually turning until it comes to rest. Check the direction. You'll find one end is pointing north. This is the north pole of the magnet; the other, naturally, is the south pole. Twist the glass as you like, the north pole of the magnet will always head toward the north. You have made a simple compass.

Break up one of the magnetized blades. Bring one end of one of the other magnets near the pieces, and you'll find that each piece acts as an individual magnet, attracted at one end, repelled at the other. Arrange the pieces with unlike poles next each other and a whole group of fragments will cling together as shown above. No matter how small the fragments of a magnet, each one will have its own north and south poles. END





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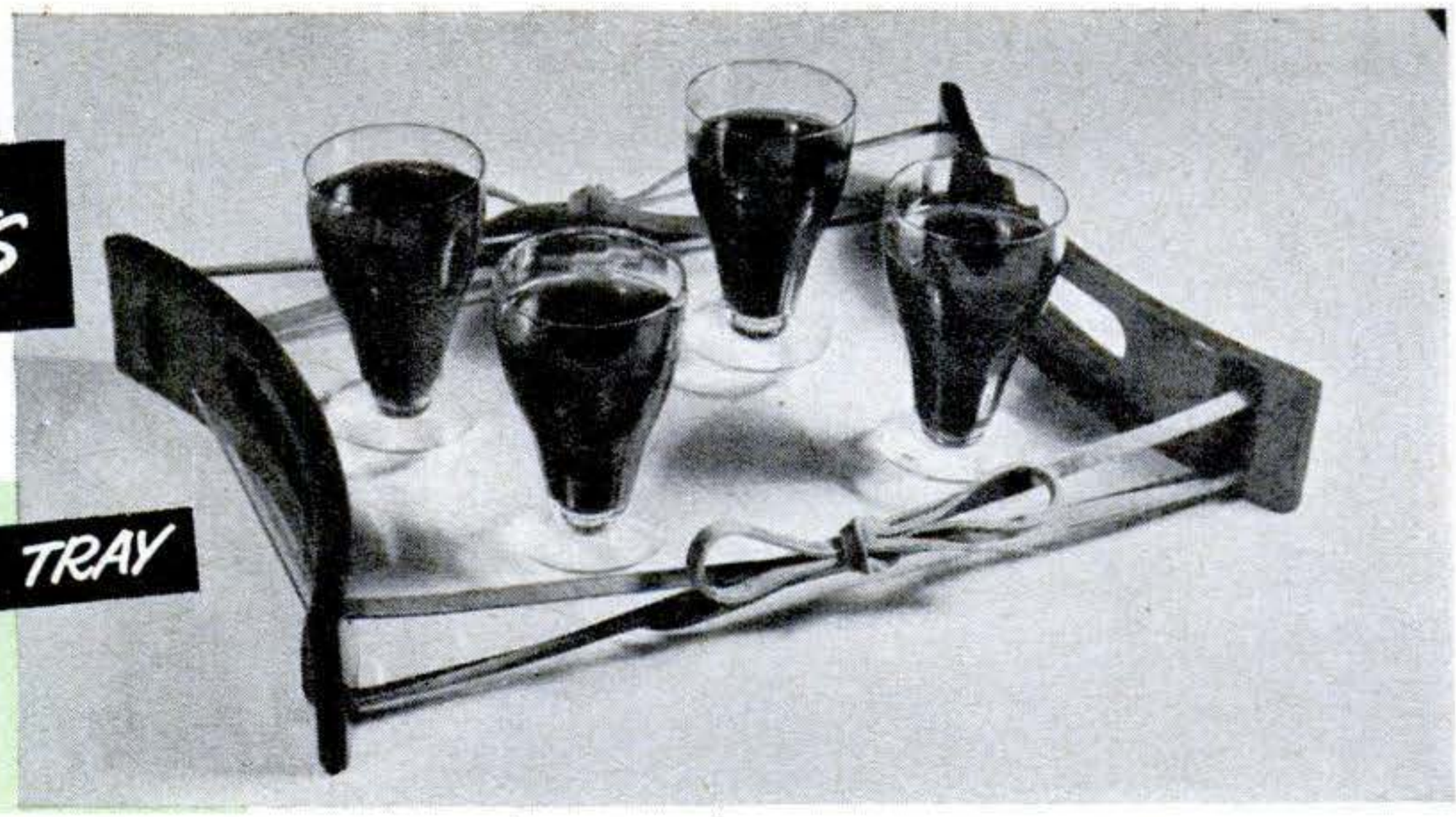
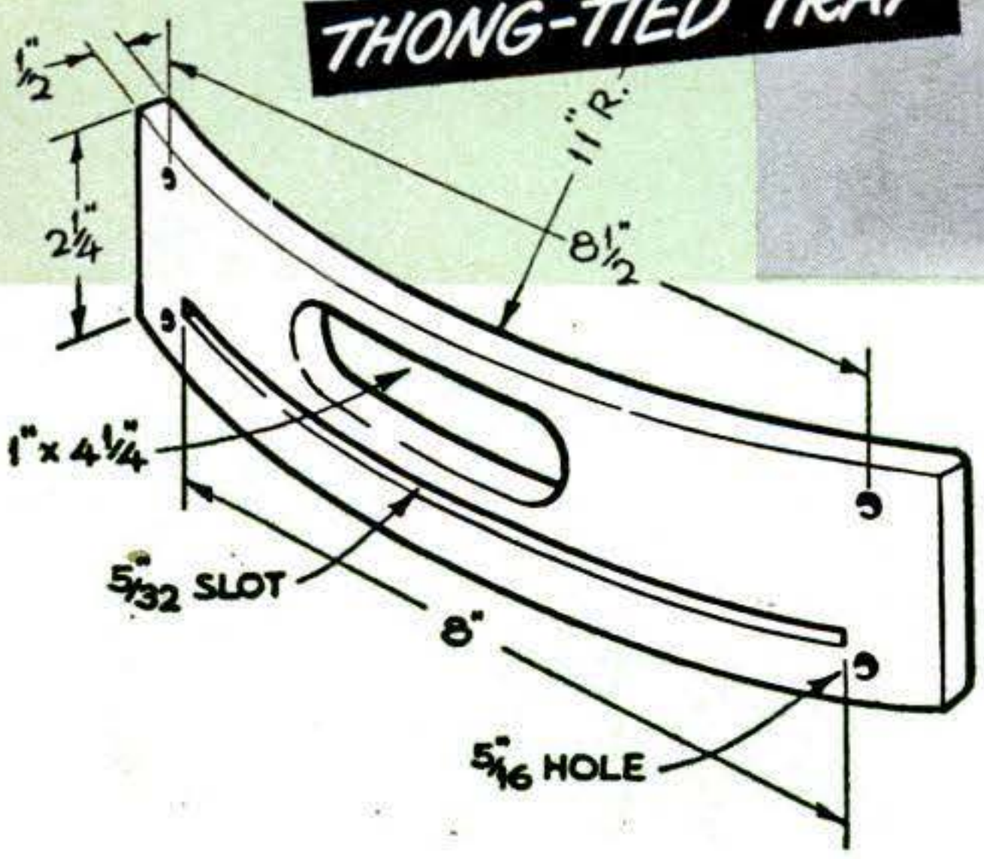
One Evening Shop Projects



THONG-TIED TRAY

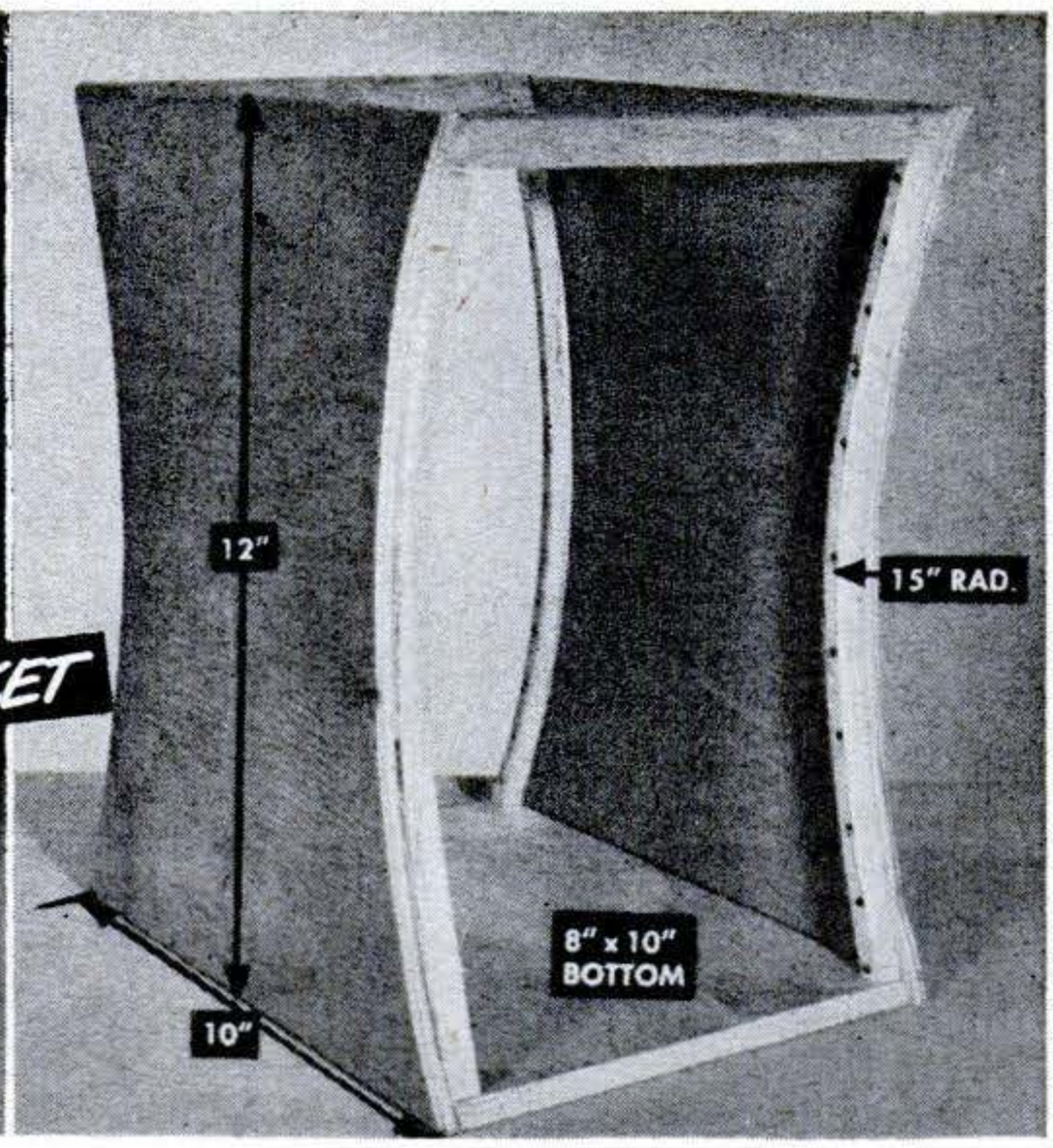


Leather thongs are the only fastenings used in this serving tray. Grooves in the two walnut or other hardwood endpieces fit over a piece of plate glass. The thongs keep the ends snug in place against the glass.

Bandsaw the ends to an 11″ radius and cut a groove in each the thickness of the glass and about ¼″ shorter than its width—so the glass can't go through. Bore holes for the straps and cut the handholes with a coping saw. Sand smooth and apply two coats of thin shellac. Rub with fine steel wool when dry and varnish to protect handles from liquids being served.

Have the edges of the glass ground when it is cut to size. Assemble the tray with two 50″ lengths of 5/16″ leather tied in bow-knots.—*Benj. Nielsen, Aurora, Nebr.*

WASTEBASKET



Scraps of linoleum, plywood and wallpaper are easy to turn into a colorful wastebasket. Nail two plywood sides to an 8″-by-10″ bottom. Glue and brad strips of wood along the curved edges and across the upper corners. Bend the linoleum to the curve of the sides and tack it to the wood strips. Cover the wastebasket with wallpaper or enamel and apply decals.—*Richard Mandle, Pompton Lakes, N. J.*

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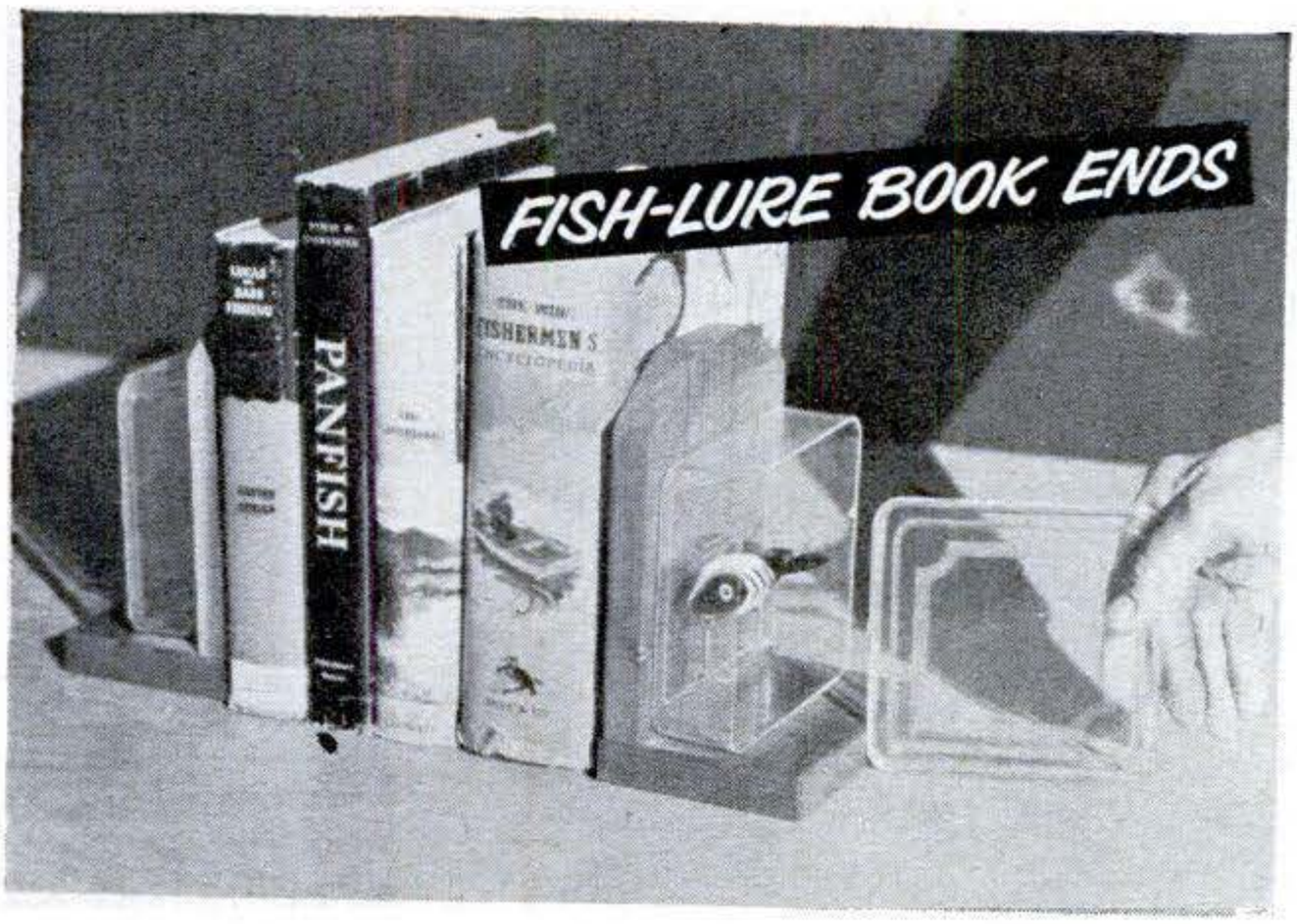
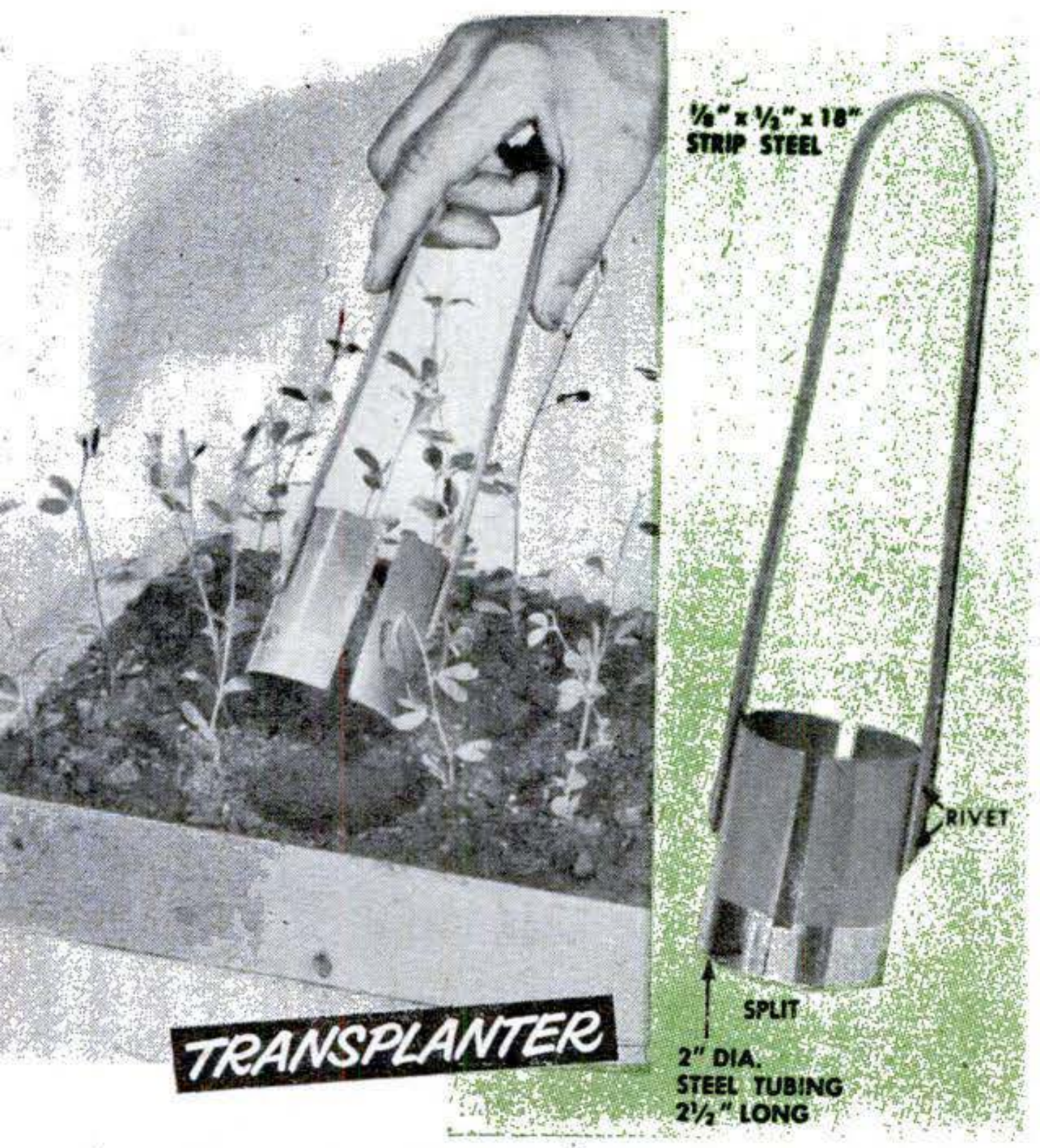
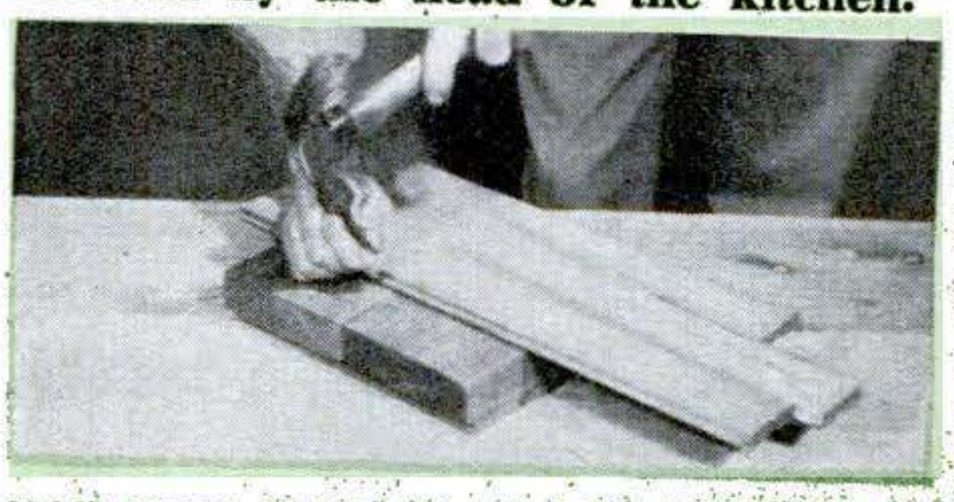


Fishing plugs are used to decorate these book ends for a sportsman's den. Glue them in plastic refrigerator-storage boxes obtained from a dime store. Cement on the box covers to keep children's fingers off the hooks. Mount the boxes on bases made of scrap wood stained or shellacked.—*Clifton Morris, Lubbock, Tex.*

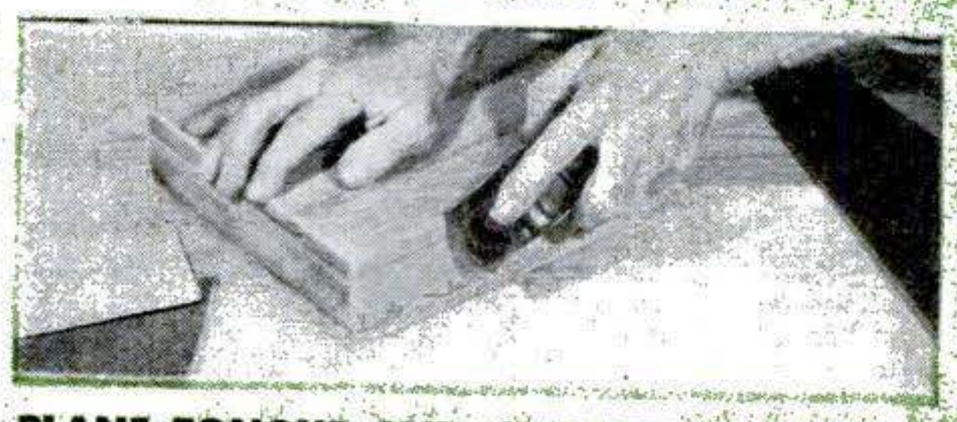


Early seedlings can be transplanted from starting flats without disturbing the roots if you use this tool, made from steel tubing and strip. Bend the strip and rivet the ends to the tubing. Split the tubing into two halves, file the bottom edges sharp and apply a coat of enamel.—*T. K. Hastings, Los Angeles.*

USEFUL AS A CUTTING BOARD too, this easily made block will be gratefully received by the head of the kitchen.



NAIL OAK FLOORING to both sides of two pieces of 2"-by-6"-by-12" pine to make block 12" square.



PLANE TONGUE AND GROOVE OFF outer pieces; cut ends flush with core. Sand smooth, and finish with linseed oil.

ADD SCREW EYE to hang block on wall. Chop foods across grain.—*W. H. McClay, Pasadena, Calif.*

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1. Jane was busy at the kitchen counter when Joe came home. He was delighted at the sight of two cartons on the table. "Good! My oscilloscope kit's come." But he frowned as he saw that one box was open, its contents strewn wide, the instruction manual propped up before Jane as she did things with a radio chassis. "Hey! Why'd you unpack my kit?"

Jane calmly tightened a screw. "This is not your kit," she explained. "It's the high-fidelity amplifier you're always too busy to make. You told Eddie Wilson he could build one from a kit without knowing electronics, and get fine music from his records and FM radio. He did, too, and it worked. So I ordered the same kit, and *I'm* going to build *us* one."

How a Kit Becomes a Hi-Fi Amplifier

Electronics was Joe's hobby, but when Jane wanted good music she ordered packaged parts and learned to use a soldering iron.

Picture story by Hubert Luckett

NOWADAYS, bank clerks and doctors, bebop fans and housewives build their own high-grade electronic units. Kits are planned to keep the beginner out of trouble. Anyone can put together an FM tuner or a high-fidelity amplifier. Directions that come with the kits cover every step; pictorial diagrams show each connection as it ought to look.

The picture story that begins on this page is fiction based on facts. It describes how two kits purchased from the Heath Company of Benton Harbor, Mich., were assembled.

Professionals as well as amateurs use such kits. Many Heathkit oscilloscopes, signal tracers and vacuum-tube voltmeters rest on service-shop benches. Training schools, labs and universities also use apparatus assembled from such kits.

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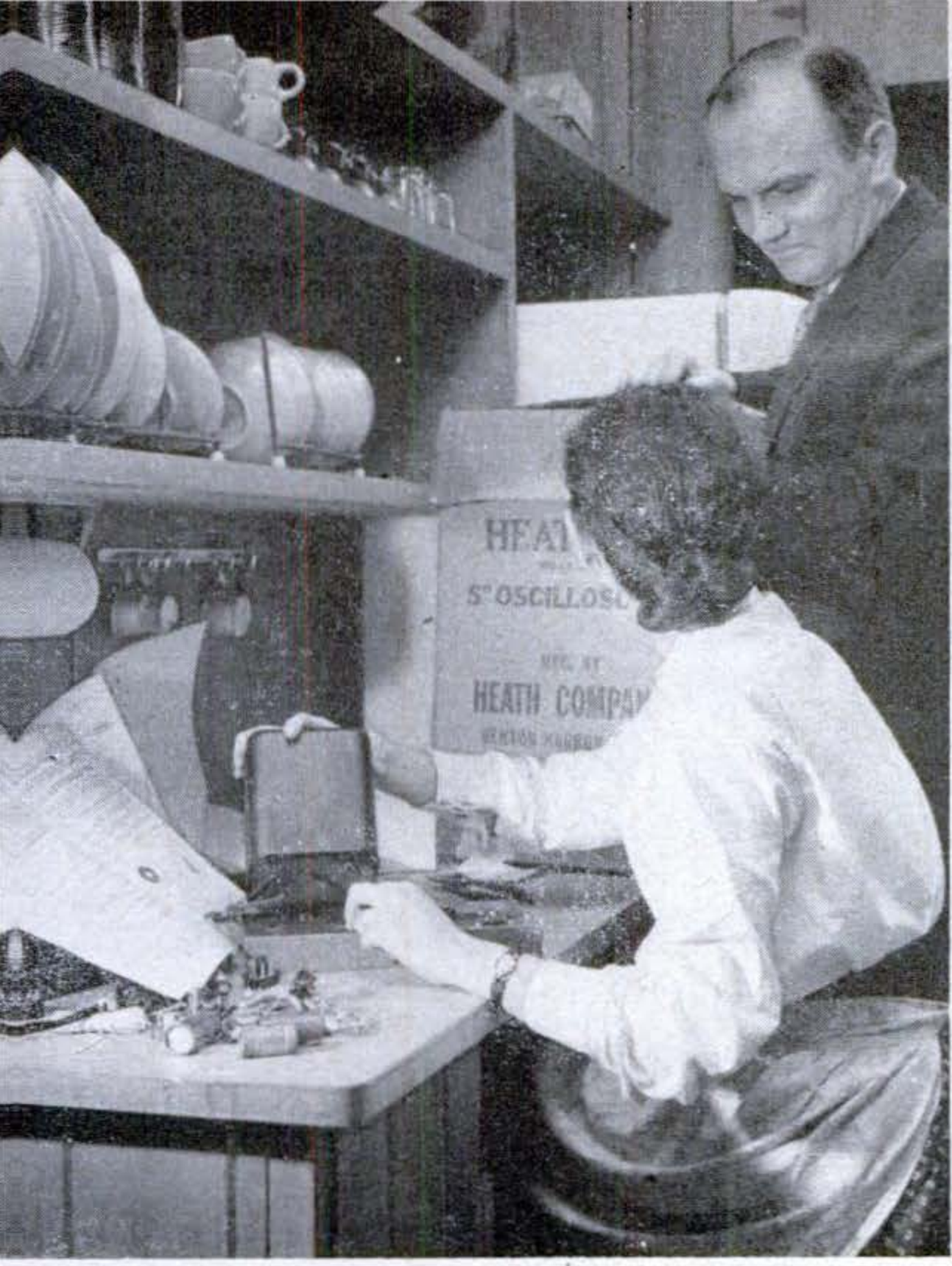


2. "*You're* going to build it?" grumbled Joe, opening his kit. "Know what you're doing?"

"I think I do," retorted Jane. "Doris said Eddie had no trouble." Joe grunted. "That Williamson-type circuit is no crystal set. Don't ask me to finish it when you give up. I've got my oscilloscope to put together."

Jane bridled. "I'm doing all right so far, mister. Go ahead and build your old squigglescope. What I want is a chance to hear good music."

3. "But at least Eddie knew how to solder. Know any women who do?" demanded Joe.

Jane smiled. "Why, yes. Betty and Norma wired airplane radios during the war. They say it's easy." Trying for a comeback, Joe peered into the refrigerator. But all he could manage was: "Hope you didn't forget supper."

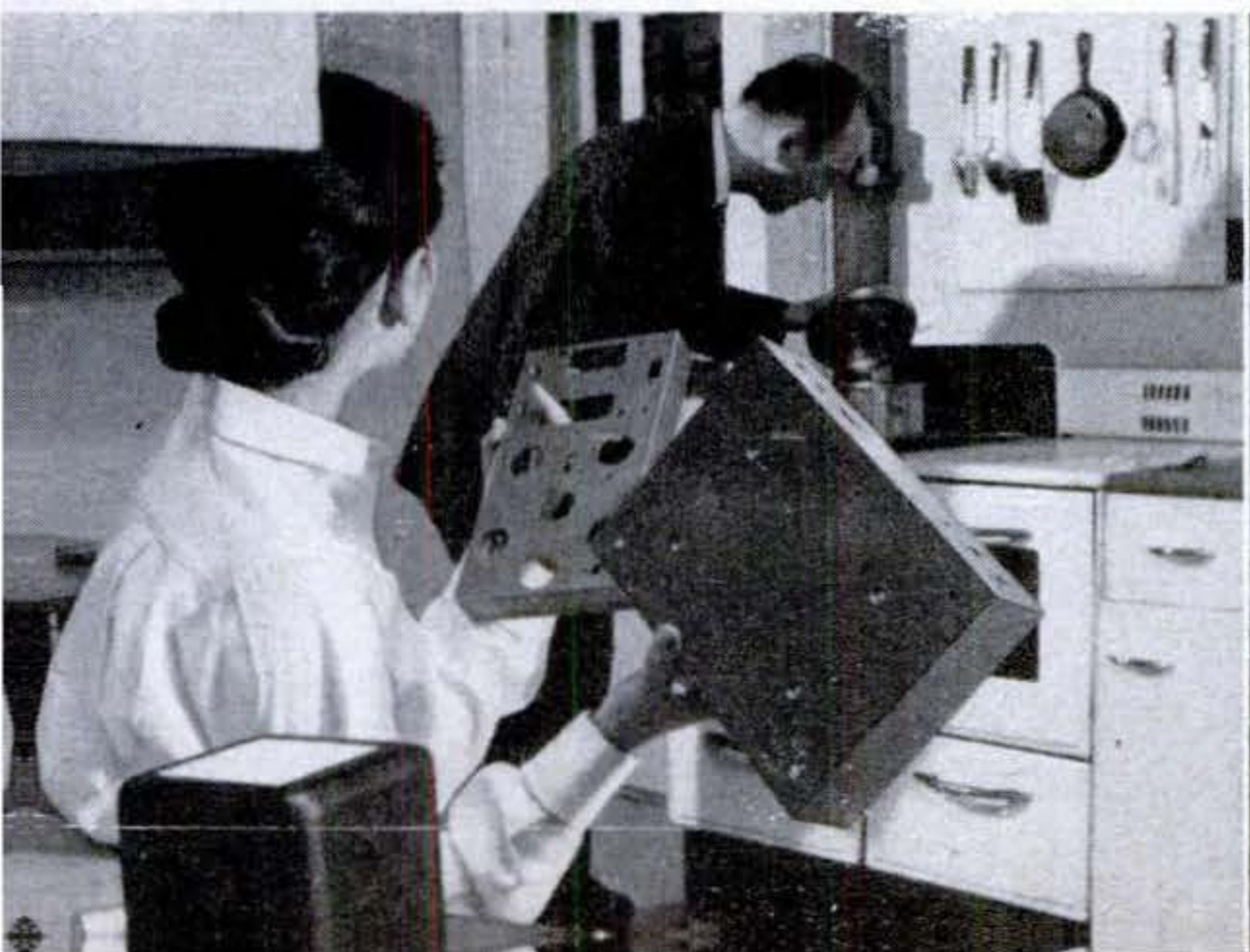
Still smiling, Jane said, "If you'll answer some questions—not do any work, mind you—I might be able to find you some beef stew."

4. "You're on," Joe agreed, looking into the pot. "Mmm—this smells wonderful. Save the questions till we eat." But Jane held up two chassis. "Why did they send me three of these? I ordered only one amplifier." Reluctantly Joe put the lid back.

"The one you're working on is the power supply. It's made separate so you can mount it away from the rest of the rig. That cuts down AC hum. The big chassis is your main amplifier, which gives the signal power to work a loudspeaker. *Now* will you set the table?"

5. Jane laid out supper. "That third chassis," Joe went on, "houses the preamplifier, which boosts signal voltage. It has all the controls on it, and you get a long connecting cord, so you can put it alongside an armchair for real lazy listening if you like. Separate units like that are good design circuitwise, and easier to wire than one huge chassis. And now let's eat."

But once the first keen edge was off his hunger, Joe divided his attention between the stew and his oscilloscope manual, while Jane read the instructions for her kit.



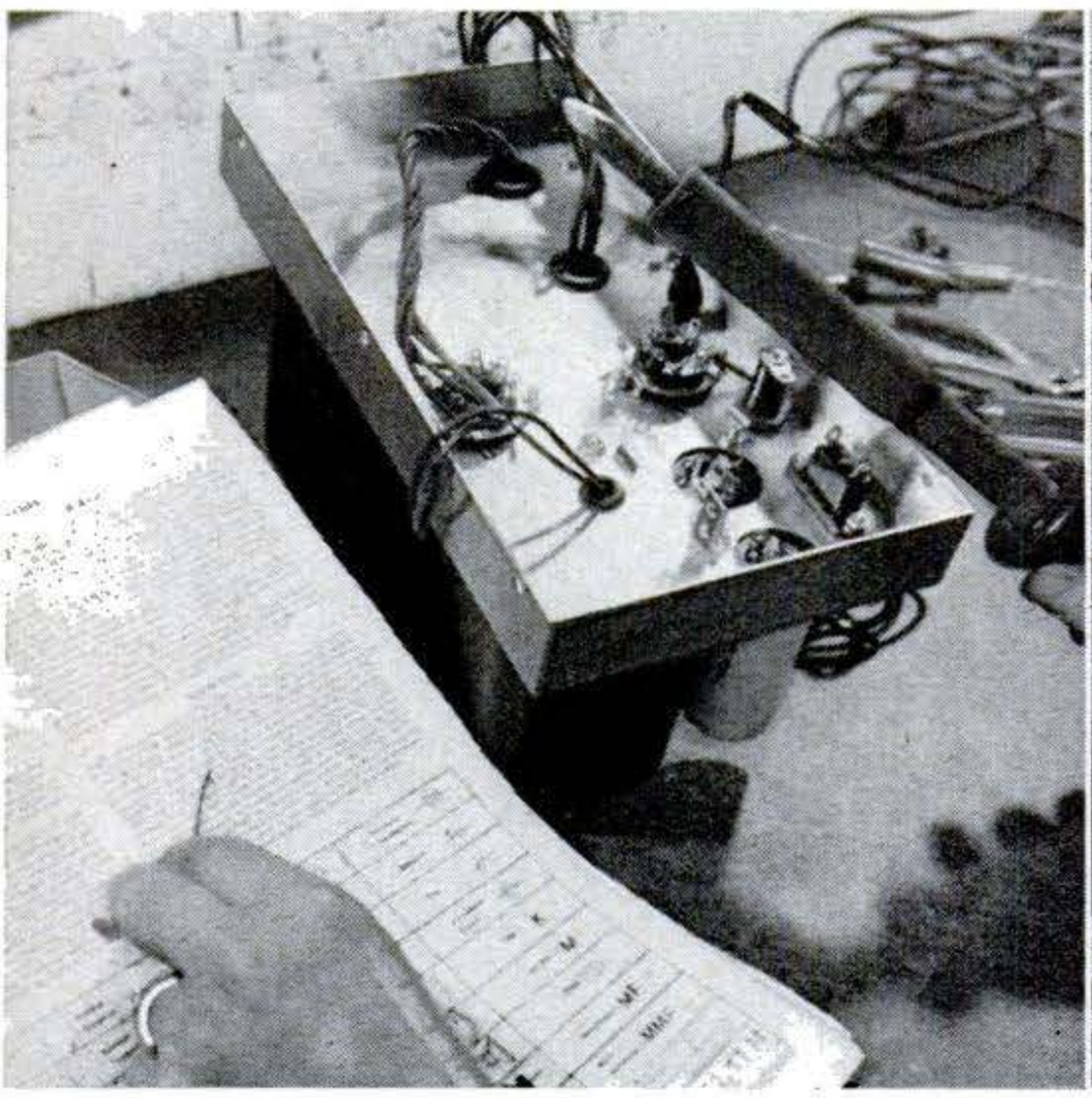
6. More amiable after supper, Joe invited Jane to continue work in the basement. "Then I can answer your questions without stopping work on my oscilloscope," he pointed out. Jane willingly installed herself at a workbench alongside his, and went on mounting parts on the power-supply chassis. Just as she finished, she discovered a mistake.

"I put on one socket with the keyway facing out," she said. "Do you think I'll have to change it?" Checking the instructions, Joe found that they called for both sockets to be mounted with the keyways facing inward.

7. "Better turn it," Joe advised. "It's only a minute's work. You see, the positioning of each part is planned for easy wiring. Besides, if you stick to the directions, every wire will look as it does in the picture diagram. But if you start with one socket turned around, the wires will run differently and you may get mixed up."

Jane saw the point. She took off the socket and remounted it properly. But her confidence took a dive as she studied the wiring diagrams closely for the first time.

"Oh no!" she exclaimed. "Do I have to hook up a separate wire wherever there's a line?"



10. Joe laughed. "Only as hard as you think. It's really easier than fastening a wire under a screw. With that clean, newly tinned iron you shouldn't have any trouble. Twist each wire around its terminal so that it's tight even without solder. Did you read the paragraph on soldering inside the back cover of the manual? If not, it's worth doing."

Jane admitted she hadn't. While the iron was heating, she took time to do so.

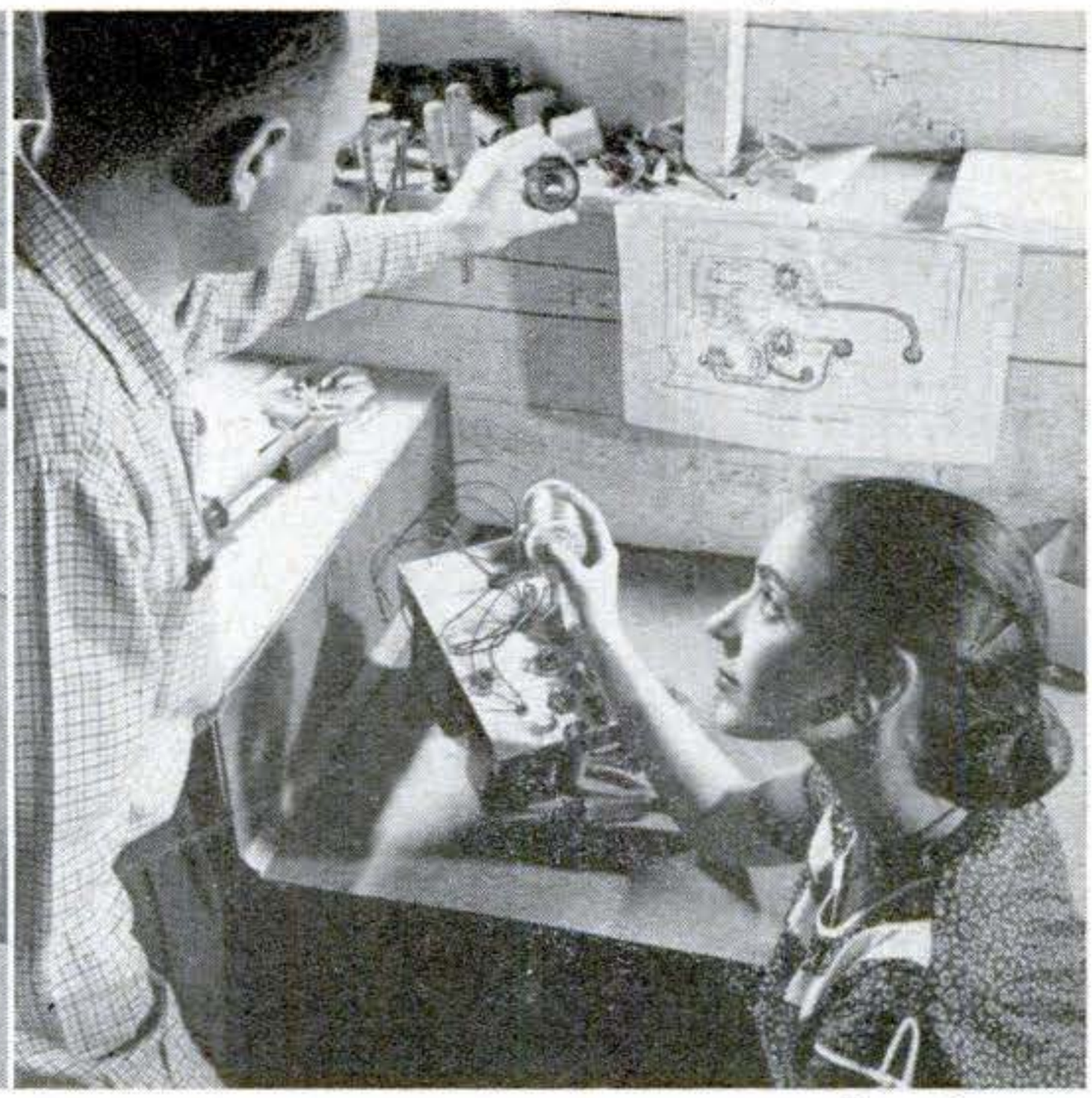
11. Holding the iron a bit awkwardly against the ground lug of a tube socket, around which she had twisted a transformer lead, she touched solder to the lug. A blob flowed on, merged with wire and lug. Hastily, Jane took the iron away. The solder hardened, and she pulled the wire to see if it held. "Look!" she said delightedly. "It works!"

Joe checked the joint. "Yes, it's okay. But try not to get on so much solder the next time."

Copyrighted material

8. "Yeah, but relax," Joe told her. "Stop looking at all three wiring sheets at once." He pinned up the one of the power supply. "Each line is a connection. But you only make one at a time. So don't get scared.

"In the instructions, a separate paragraph for each one tells you where the wire comes from, where it goes and what to do. If there's an S in parentheses, you solder the joint. If there's an *NS*, that means 'no solder,' because another wire has to go there first. Why, there's even a place to check off each connection as you make it. You can't miss with this job."



9. "Then I'm ready to start wiring," said Jane. "Look, I did remember to buy solder, so that I wouldn't have to take yours." Proudly she held up a spool, but Joe reached for his own. "Yeah, only you got acid-core solder. That's okay for mechanical work, but poison on radio and electric wiring. The guarantee is void if you use anything but rosin-core radio solder like this. I'll cut some off for you."

Jane took the solder and an electric soldering iron. "I wonder if the girls were just trying to encourage me," she said dubiously. "Is soldering really pretty hard to do?"

12. Pleased to find she could solder, Jane made joint after joint. But the last one stumped her. "Now what?" she complained. "The solder won't melt, or it goes where I don't want it."

In one quick glance Joe diagnosed the trouble. "You've had the iron hot a long time. The tip is oxidized. It needs a shiny coating of solder to work properly." Jane sighed. "I thought it was me! How much are these irons, and how many of them will I need to buy?"

13. Chuckling, Joe took the iron from her and filed the tip bright. "You just clean and re-tin this one," he said. After rubbing a fresh coat of solder on the tip, he made a joint on the oscilloscope to demonstrate.

"See how I hold the iron, like a dagger? It's less tiring and gives you better control that way. Now go ahead." But Jane was tired. "Let's call it a night. Tomorrow we'll start early, and I'll bring down sandwiches for supper."

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14. When Joe got home the next night, he found Jane already downstairs, sticking resistors into a piece of corrugated cardboard taped to a block. "What's doing?" he asked.

"Oh, there's such a slew of these little things," Jane said, "I thought I'd better sort them out. I didn't know what the colored lines meant at first, but this code in the manual explains it. They tell how many ohms each one has."

Joe laughed. "That cardboard stunt is pretty slick. Think I'll use it myself from now on. It sure beats poking into a jackstraw pile of resistors to pick out the right one."

15. After mounting the main-amplifier parts, Jane knocked off to go upstairs for coffee and sandwiches. Jimmy, the three-year-old, was allowed to stay up past his bedtime for the occasion, which he thought pretty special.

"I almost forgot to tell you," said Jane. "This is our bridge night with the Wilsons." Joe groaned. "I'd rather work on my oscilloscope. Can't we beg off?" With a self-satisfied grin, Jane shook her head. "Don't have to. I told them what we were doing, so they agreed to pass up bridge and visit with us down here in the basement while we keep working."

18. Two nights later, Jane soldered the last joint, shook out all loose solder and wire, and put in the tubes. Joe hooked a mysterious box and his oscilloscope to the amplifier. Switching it on, Jane waited tensely for the usual warm-up time. But there was only silence and a seesaw of green lines on the oscilloscope. Her spirits hit bottom.

"Your gadget works, but mine doesn't," she whispered. Joe first looked puzzled, then laughed.

"Oh, because you don't hear anything? But we're feeding the scope, not a speaker. Your rig is amplifying a square wave, the toughest test for an amplifier. Many that sound good won't show a recognizable square pattern.

"But yours—well, just look at that scope pattern—the top and bottom lines horizontal, corners square and sharp. Among other things, that means flat response—all frequencies are amplified equally. Of course, you can favor highs or lows with the tone control."

"So what?" protested Jane. "I don't want to see squiggles on a tube. I want music!"

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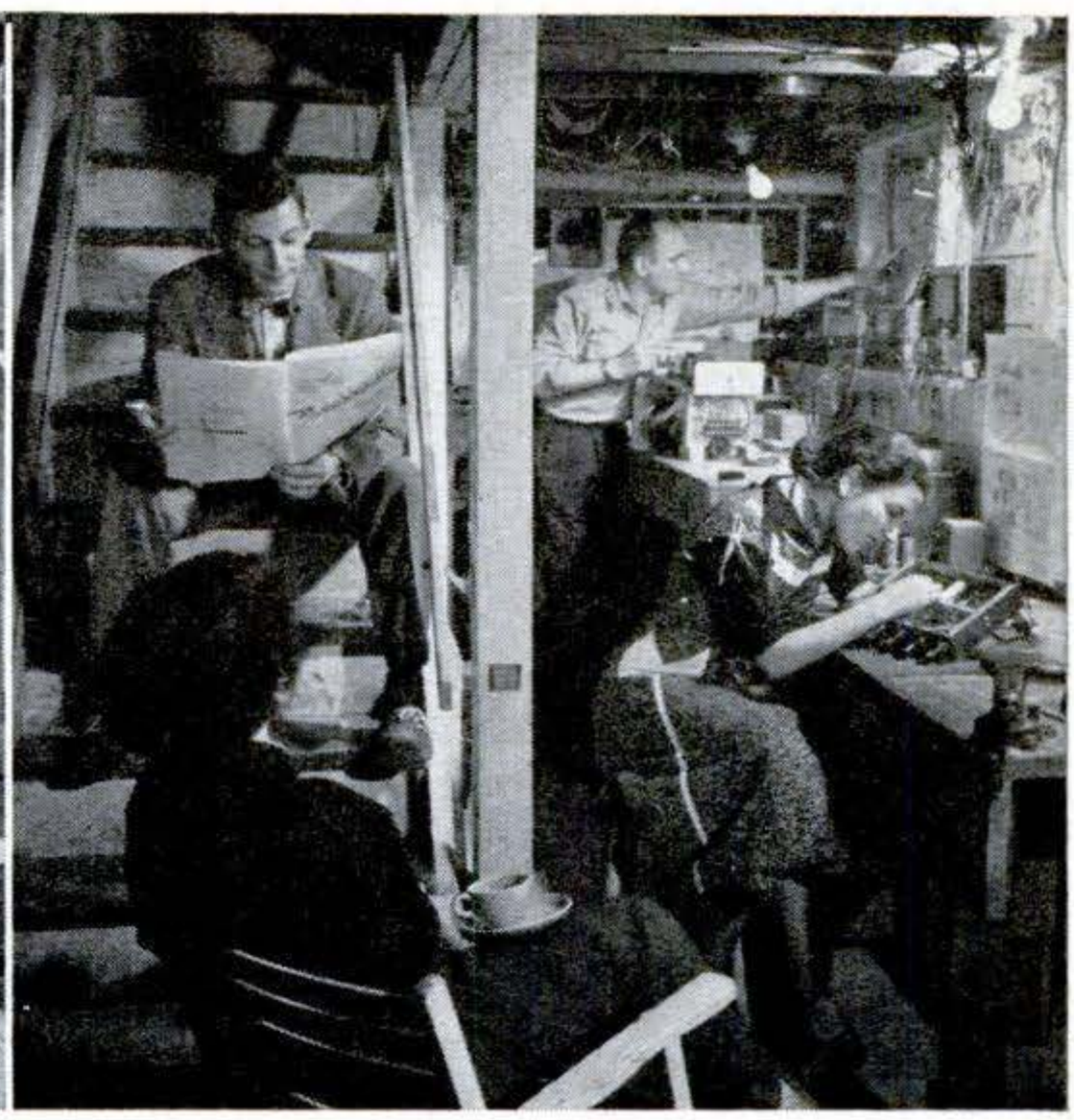

16. Shortly after eight, the Wilsons let themselves in and came downstairs. Eddie headed for Joe's workbench. "That oscilloscope looks mighty professional," he remarked. "I'll give you all my radio and TV repair work!"

Doris was more interested in Jane's doings, and plainly impressed. "However do you know what all these gadgets and wires do?" she asked.

"I don't," answered Jane. "But then, I don't know what chemical changes go on in the cake dough after I slip it into the oven either. All I do is follow the recipe, whether it's for a cake or a high-fidelity amplifier."

17. Joe yelled for the soldering iron then, so Jane put aside the main chassis and turned to the preamplifier, which she had partly assembled that day. Wiring up the tiny sockets was finicky, but deft fingers and a businesslike squint did it. "How long will it take you altogether?" asked Doris.

"She'd better hurry," put in Joe. "When my scope is done, I want to use it to find out just how good that amplifier of hers is."

Jane took up the challenge. "You're on. And I'll bet you a steak for supper it won't have taken me more than 12 hours in all."

19. Late as it was, they carried the amplifier upstairs and hooked it to a record player and speaker. Beethoven's Ninth Symphony came sharp and clear, with thrilling high notes Jane had never heard before, and deep, stirring bass passages. From her chair she could adjust tone and volume. "That recipe really came off," she murmured.

"Sounds mighty good," admitted Joe. "Now there is an amplifier that deserves a really good speaker and a proper enclosure for it."

Jane was delighted. "I'm so glad you are taking an interest in home music at last," she said. "When will you build those?"

Joe thought fast. "I've got to make a few changes in my scope. Tell you what though—you come downstairs tomorrow night and I'll show you how to run the circular saw . . ." END

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What Would You Do?

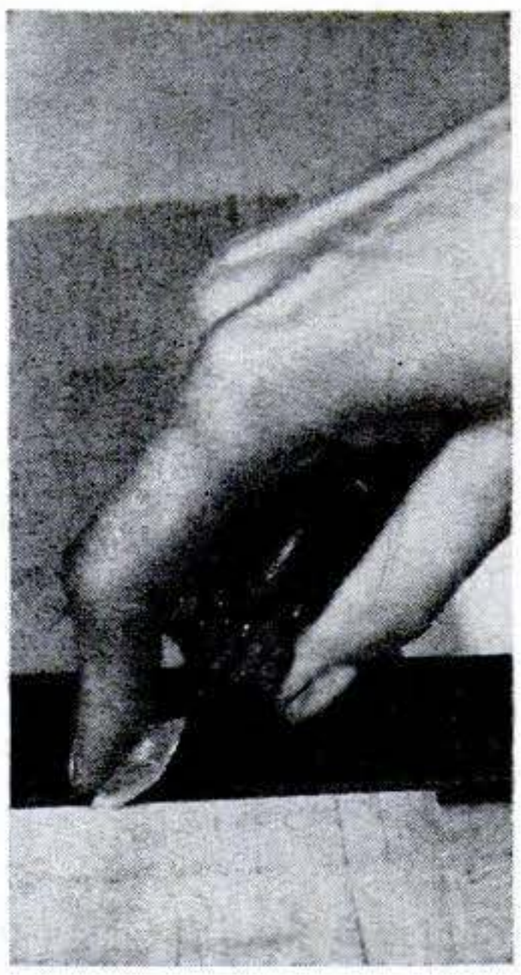
The vet had my dog on a reducing diet. My job was to weigh him from time to time and report to the vet. In the first place, Rover wouldn't stand still on the scale. This caused the needle to jiggle so you couldn't get an accurate reading. And then he would make a leaping take-off from the scale.

But I weighed him anyway. I simply picked him up and stepped on the scale. Then I weighed myself and deducted my weight, leaving the dog's poundage.—*Mrs. Henry Josephs, Gardenville, Pa.*

Coating Aids Blade Sharpening

RESHARPENING plane and chisel blades will be easier if you first coat the cutting edges with layout blue or black stove polish. The coloring will insure even sharpening, show up any low spots and eliminate overgrinding. A pipe cleaner is a good brush.—*Ken Murray, Colon, Mich.*

Screwdriver Is Scoring Knife



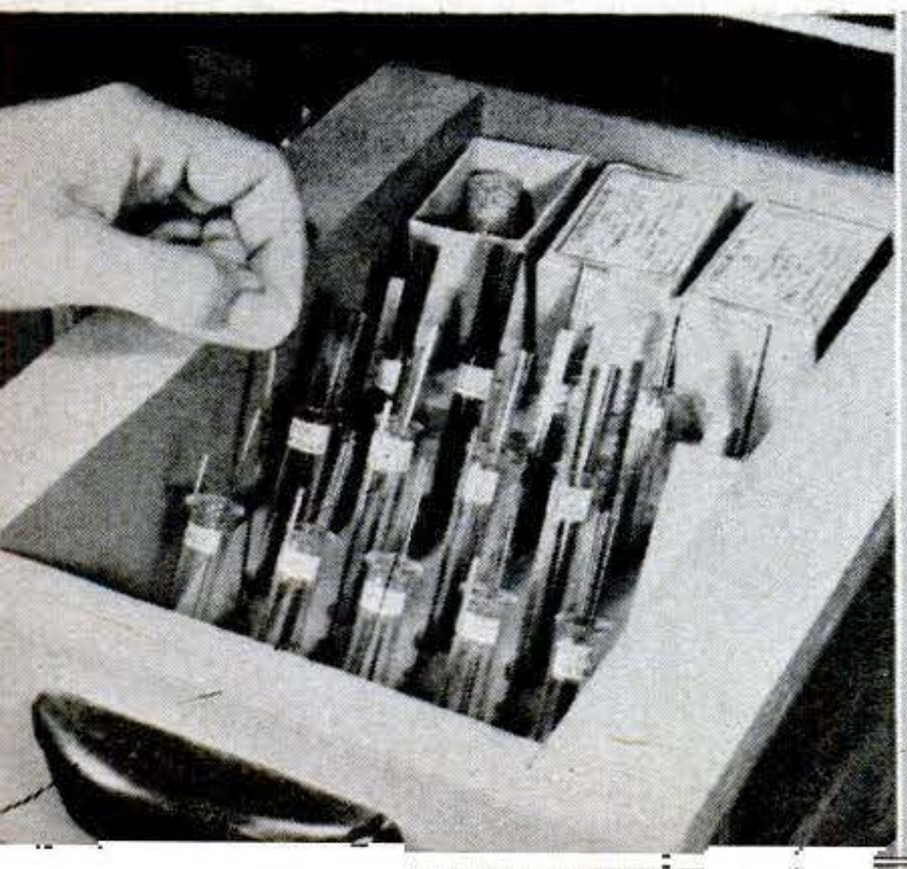
AN OLD or broken screwdriver, cut down to a stub and ground to a keen edge, will make a rugged and accurate scoring knife. The sturdy handle is easier to grip than a penknife, and you don't have to worry about dulling or nicking a good blade on the steel straightedge.—*Charles Smith, Jacksonville, Fla.*

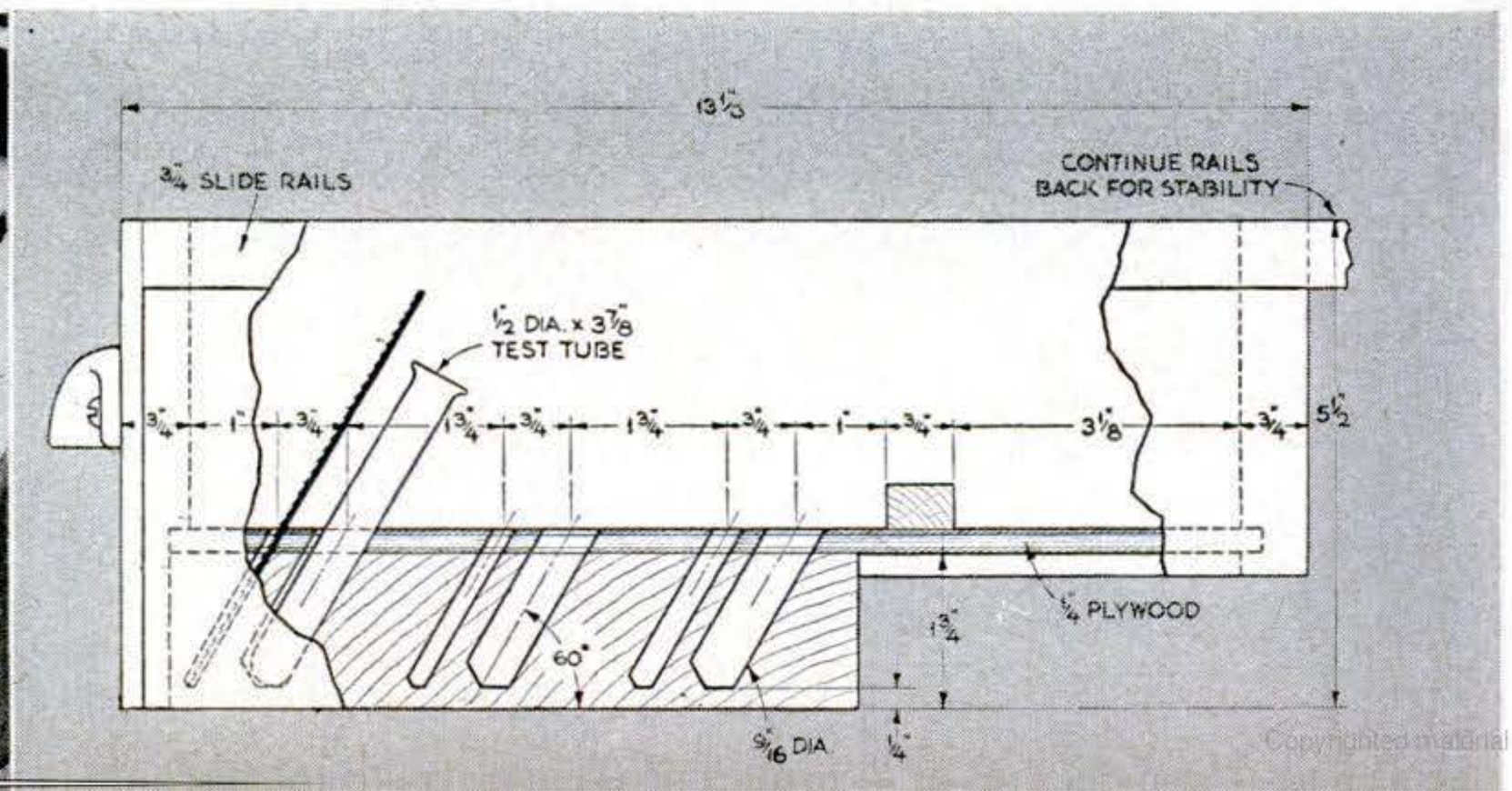
Kids Safe in No-Handle Car

WHEN I bought a four-door sedan, I removed the inside rear door handles, sawed them off and put back the stubs. The youngsters can't open the doors, but adults can reach through the window. I bought two extra handles for use when I trade in the car.—*G. E. McCahey, Providence.*

Rack Sorts Old and New Jigsaw Blades in Numbered Test Tubes

IT'S easy to find your jigsaw blades if you keep them in a small rack of glass test tubes like this. The tubes, available at any drugstore, fit in angled holes drilled in a base block and are labeled according to each blade number and use. A small hole near each tube holds the blade currently in use apart from the new ones. Spacing of the holes is shown in the sketch, and you can make the block wide and deep enough to take as many rows of tubes as you like.—*Karl Greif, Vestal, N. Y.*





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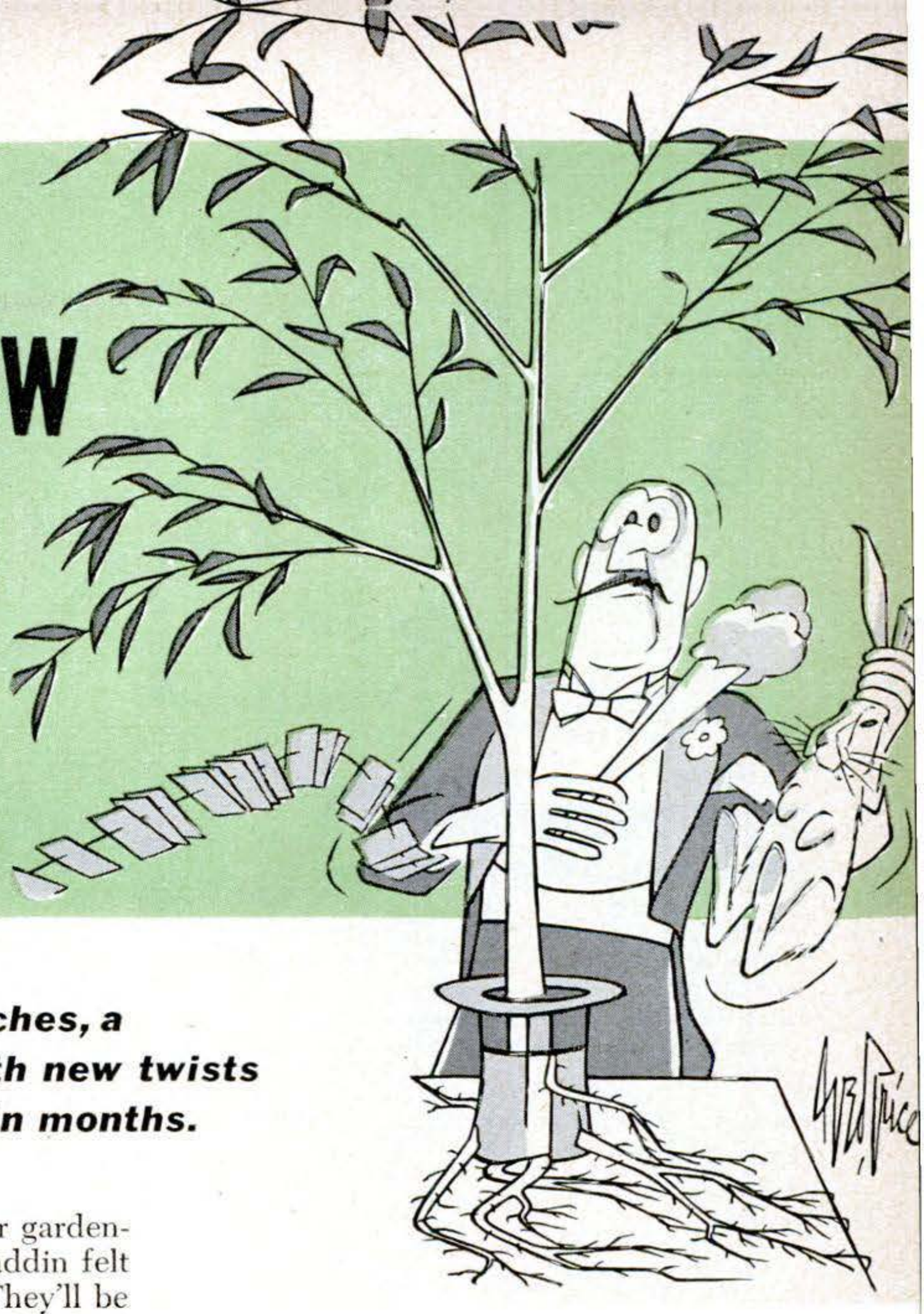
How to Grow a New Tree Fast



By growing roots on branches, a centuries-old process with new twists turns out a 10-year tree in months.

THIS year, thousands of amateur gardeners are going to know how Aladdin felt when he rubbed his magic lamp. They'll be dusting a branch of some thrifty old plant with a sheet of specially treated plastic. Then, presto! The branch will grow into a brand-new shrub or tree.

Of course there is more to this magic than meets the eye. Grandma will probably sniff when you tell her about it, and say, "Sounds to me like a new-fangled version of pot layering."

The little lady will be 100-percent right. For "air layering," as the process is called, is only a stepped-up version of a gimmick she used half a century ago to do a recap job on her rubber plant.

When its shiny leaves reached for the ceiling, Grandma grabbed her pruning knife and cut a number of notches in the bark, just below the thick growth at the top of the plant. Into each notch she slipped a pebble, to hold the bark away from the greenish cambium layer beneath it.

Then she got out a special flower pot—the one with a vertical slot cut through its side and halfway across the bottom. Grandma slipped the pot right over the stem, where it formed a cup around the wounds, and tied it firmly in place.

Next step was to fill the pot with loose earth, and water this loam sparingly for days and weeks on end. Eventually, a heavy root-mass sprouted from the notches. At this point, Grandma severed the stem right below the flower pot, and had herself a brand-new, well-formed rubber plant.

Chinese Knew the Trick, Too

Although Grandma didn't know it, Aladdin's cousins had practiced the same form of surgery in the Imperial Chinese Gardens more than a thousand years before. They used grains of rice to hold the bark away from the cambium layer, and preferred straw to earth as a moistening agent.

But all the fuss and bother of carefully controlled watering discouraged widespread use of "pot" or "Chinese" layering. That was too bad, because the method has two big points in its favor.

One is the fact that any form of rooting

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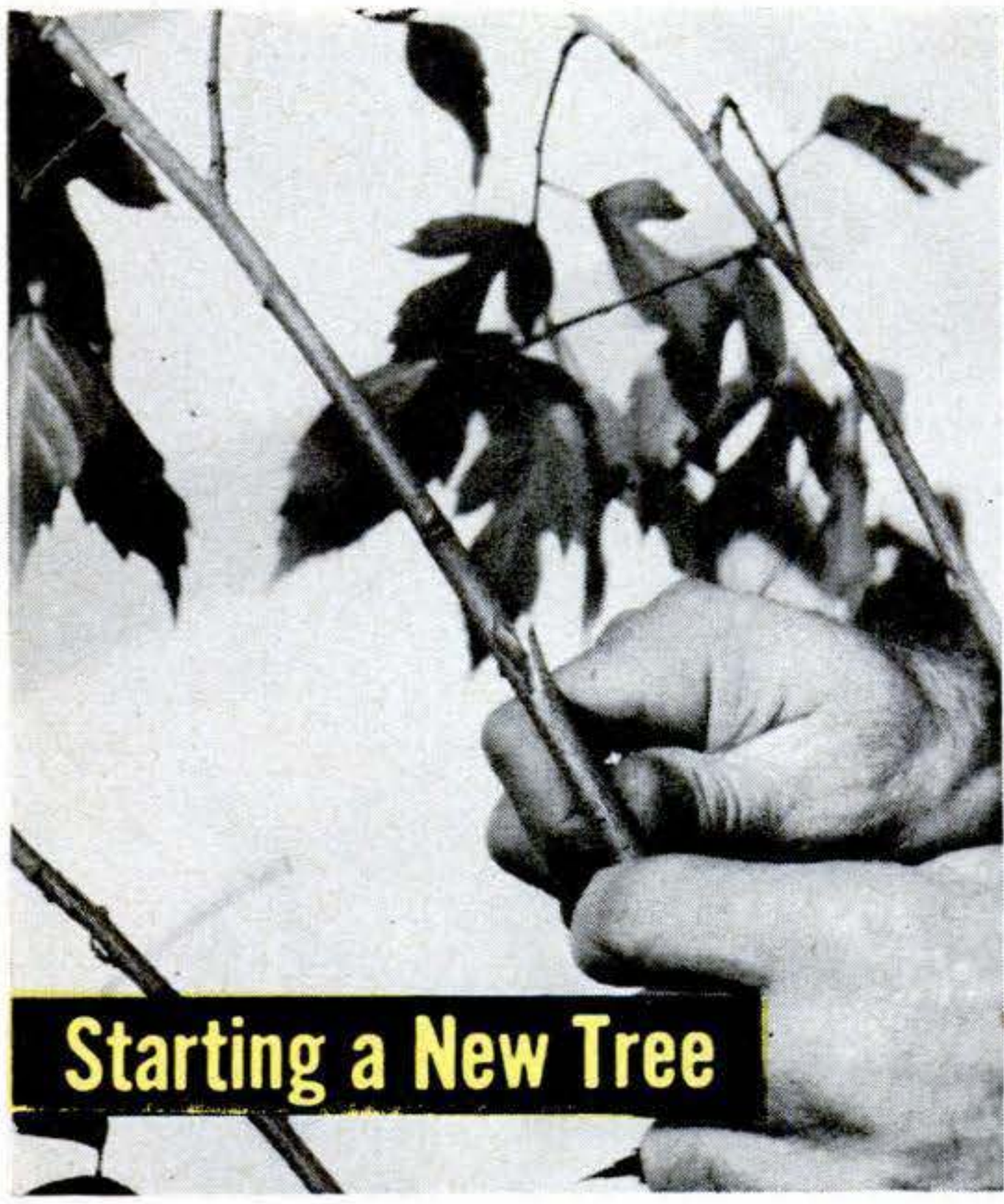

WOUNDING STEM by notching or girdling is first step. Wound is then scraped clean and a small quantity of root-inducing powder—a plant hormone—inserted into it.

SPHAGNUM MOSS is next pressed around wounded stem. A handful of damp moss squeezed tightly together stays in place until the plastic wrapping is tied around it.

—and this is strictly a rooting operation—produces a plant that bears blossoms or fruit identical in every way to those on the parent plant.

Hardiest Limb Is Chosen

The second point is important too. While the only commercially practical kind of rooting, until recently, called for a branch to be bent into a shallow trench in the ground, some shrubs and most trees do not lend themselves to this treatment. Their branches are either too brittle or too high. But with pot or Chinese layering you can pick the hardiest limb for rooting, no matter where it happens to fork from the main stem of the plant.

All that was needed, then, was a lazy man's substitute for the laborious watering process and, if possible, some method of speeding up root growth.

Solutions to both problems have come within the last few years.

First, a number of sheet plastics have been developed which, while waterproof, are still porous enough to let oxygen and carbon dioxide pass through. These properties fired the imagination of Col. William R. Grove of Laurel, Fla. In 1947, Col. Grove, who grows lichee nuts, took clumps of sphagnum moss, moistened them slightly and wrapped them around girdled branches—branches with a ring of bark stripped off—of his oriental trees. Then he carefully sheathed the moss in vinyl plastic. The warm rays of the sun soaked through the plastic, but no water could escape. Soon tiny roots were reaching into every crevice of the sphagnum. When they had formed dense spherical masses, the colonel severed his new "trees" from the parent plants. From that point on he was in business in a big way.

Root Formation Speeded

To make air layering practical in northern climates, technicians at the United States Department of Agriculture's Experimental Station at Glenn Dale, Md., added the final touch. They applied a root-stimulating hormone to the cambium layer before covering it with sphagnum moss. This hastened the formation of roots, producing a thrifty mass in time for planting in areas where first frosts come early.

The results of the Glenn Dale tests have been amazing. It has been proved that a majority of woody plants can be easily and cheaply reproduced by this form of layering. Some trees equivalent to normal five- to ten-year-olds are being developed in from five to eight weeks.

Anyone can join in the tests. Glenn Dale

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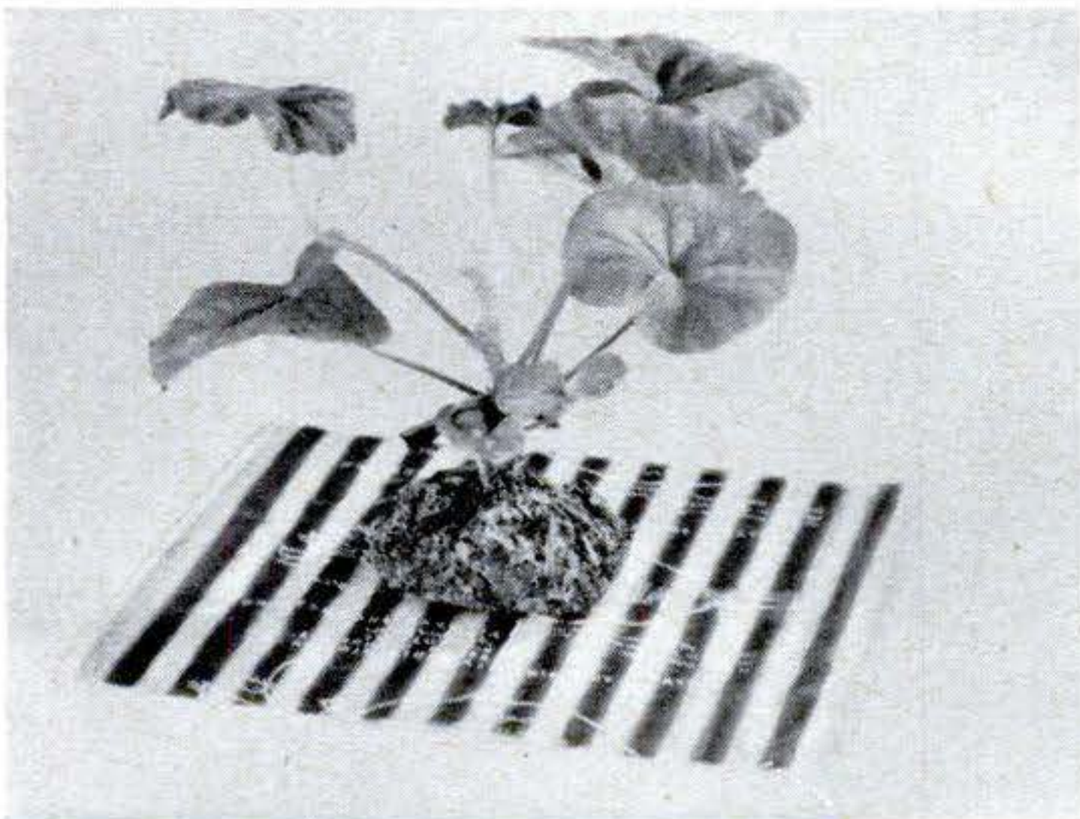
PLASTIC cover is now wrapped around moss, twisted at ends and tied securely with elastic bands. This makes a moisture-retaining but gas-permeable bag over the moss.

ROOTS on branches above were grown by air layering between May 4 and August 14. Branch is now cut away just below roots and planted either in a pot or in the ground.

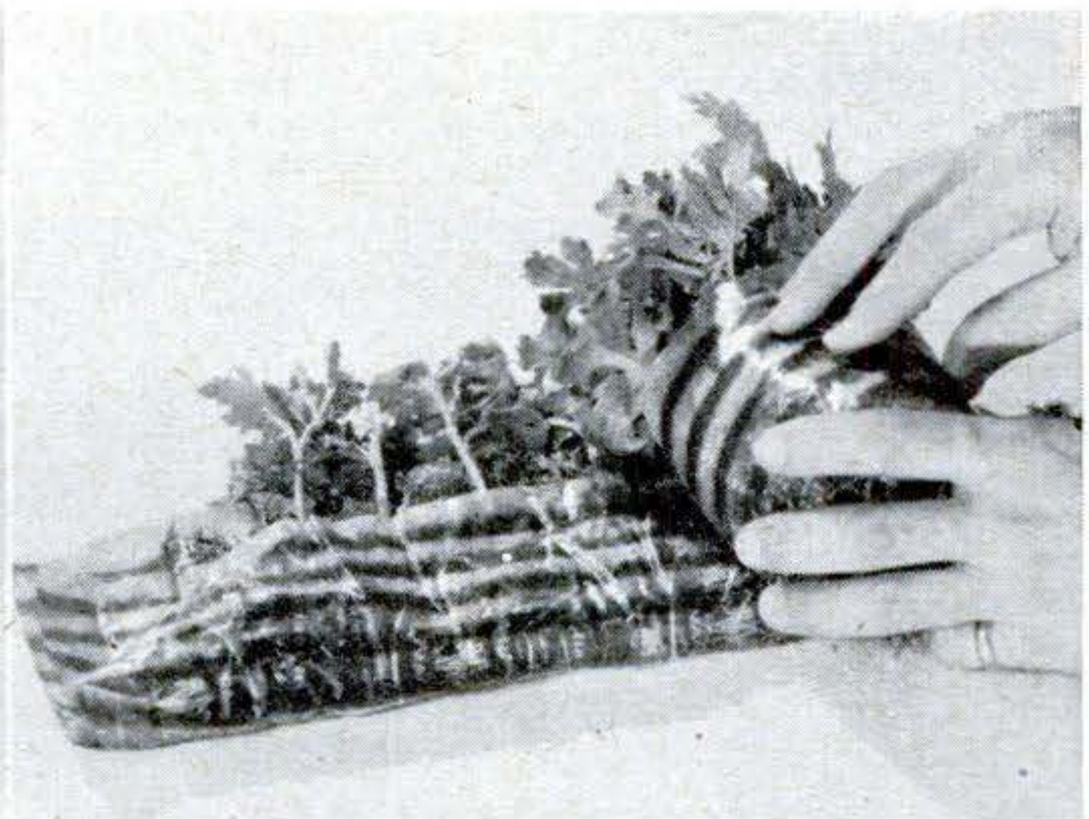
welcomes reports from would-be Luther Burbanks. All anyone needs to get in the act is a sheet of vinyl plastic (the kind used to keep vegetables moist in a refrigerator), a clump of sphagnum moss as big as a small boy's fist and a pinch of Hormodin No. 3, which is available at most of the larger nurseries.

Or, if tracking down materials like these is too much trouble, the Agri-Plast Corp., P.O. Box 142, Sarasota, Fla., has a home kit containing enough moss and hormone-surfaced plastic to make eight rootings, for $1.95. According to the legend on the package, you simply rub the marked surface of the plastic on the cambium layer of the girdled branch, before applying the sphagnum moss. That starts a new plant on its way as quick as you can say "*Chaenomeles lagenaria.*"—*Henry B. Comstock.*



Starting a New Plant

PLANT CUTTING is rooted by air layering, speeding growth as much as 75 percent. Cutting above is nestled in moss, wrapped with Airwrap, a hormone-coated plastic.



MANY SMALL CUTTINGS can be packaged at one time for shipping and rooting by laying them out on a strip of moss backed by Airwrap plastic, folding the plastic into an envelope, and rolling up the whole lot together. Center of the roll is then pushed up so that inner cuttings get light and air.

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Ball on a Pole Makes a Fast Yard Game

A few hours and dollars invested in building a tetherball court will pay big dividends in fun.

CROSS volleyball with a Maypole dance and you've got a good fast game—tetherball. You can play it anywhere there's room for a 20′ circle. And all you need, besides the tetherball itself, is some $8 worth of materials and a couple of hours' work digging a hole and pouring concrete.

If you become a tetherball fan, you'll have plenty of company—12 times as many people are playing the game today as in 1948. The game itself is deceptively simple. The ball is hitched to the top of a pole with a rope. The players face each other and strike the ball with their hands, trying to wind it around the pole in opposite directions. Simple or not, it will give you a real workout.

In somewhat different form—played with paddles or tennis rackets and a small ball—tetherball has been around a while. But the game that is booming today uses a 13½ oz. ball that is 8¼″ in diameter when inflated medium hard (about three pounds of pressure). Some balls are leather, and are hitched to the rope with straps. Nine out of 10, however, are rubber covered. These have an indentation, developed by the Voit Rubber Corp., which allows the rope to be fastened on without a projecting knot. A good tetherball should last several seasons.

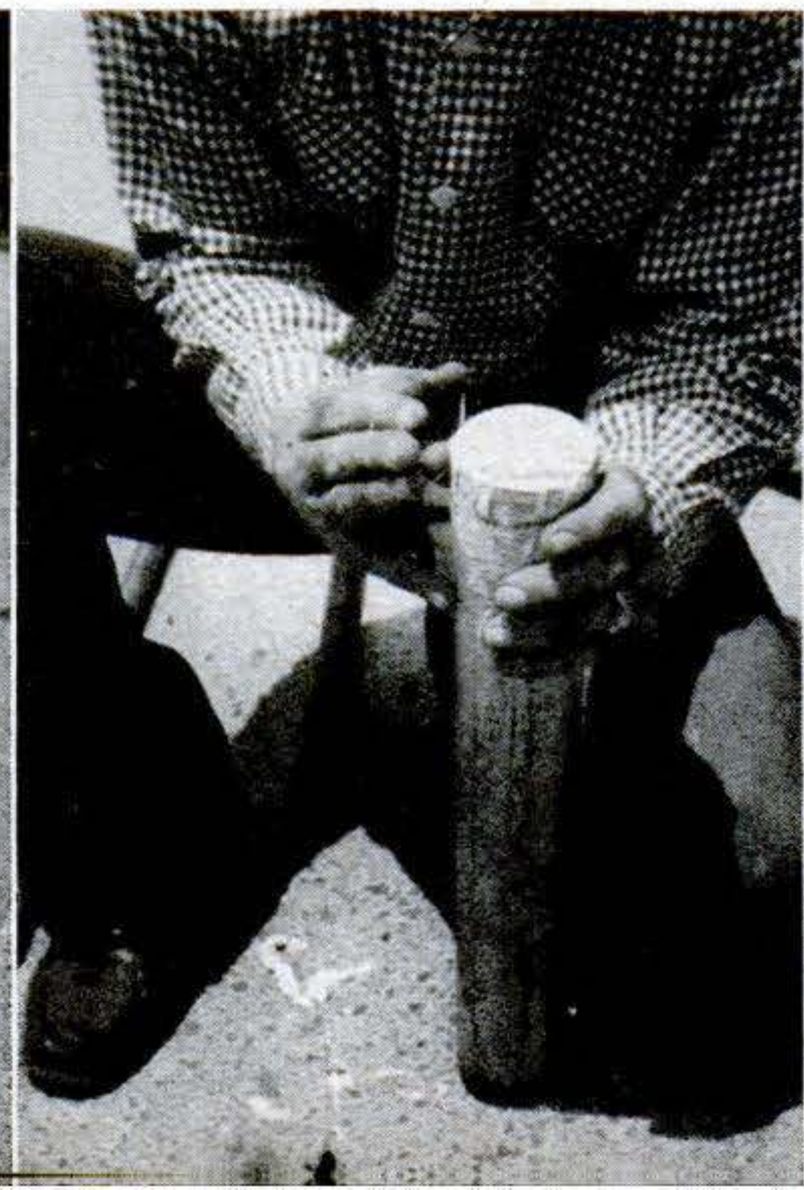
The best surface for a court is concrete. As shown in the photographs, the area where a driveway widens for entry into a two-car garage is a likely spot. Any hard surface will do, however. If you play on dirt or turf, you'll have to mark the lines with lime or tennis-court tapes.

As shown in the pictures, you can fasten a chain to the pole, then snap the ball and line to it, making it easy to take it off when

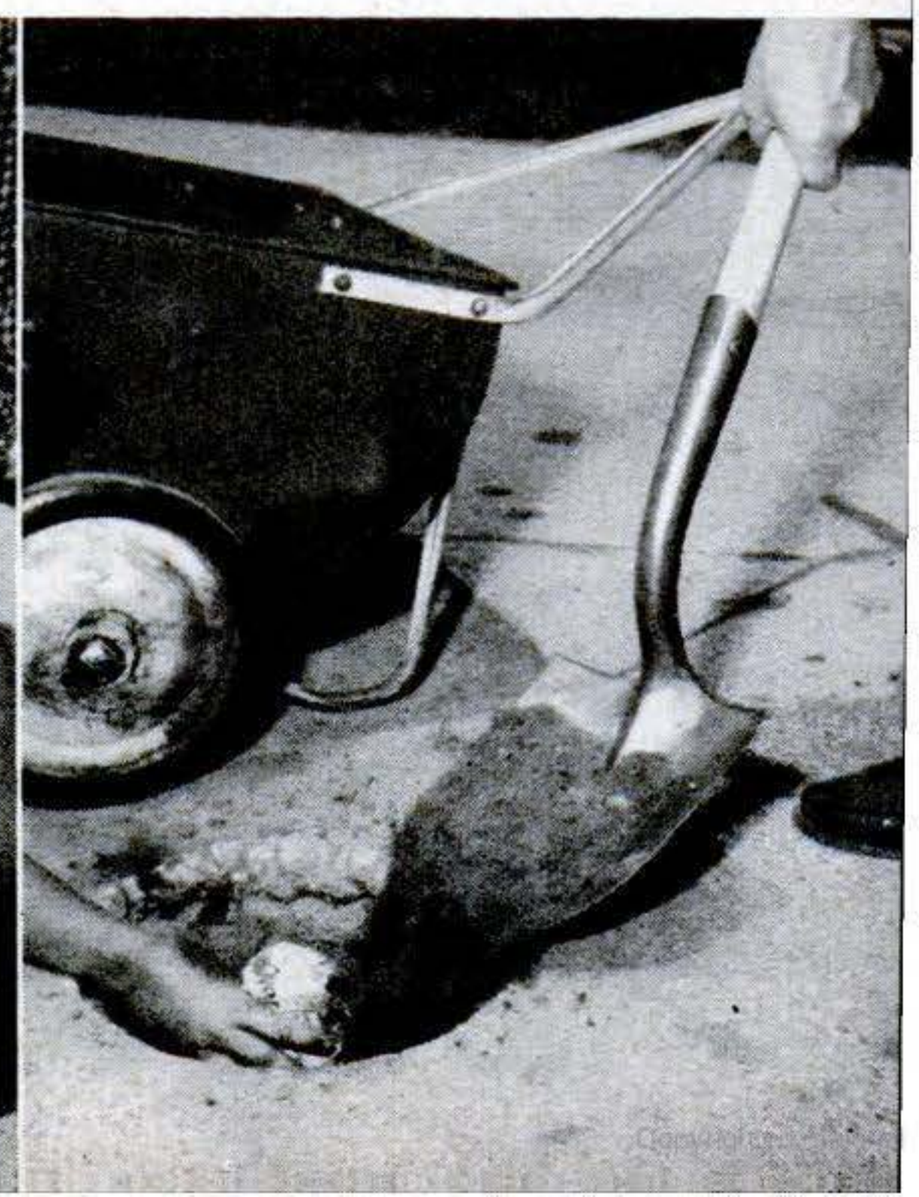
How to Build the Court

HOLE for center pole is started by first selecting spot with room for 20′ circular court, then chiseling away concrete from within 8″ circle. As shown, work toward inside to prevent cement cracking outward. Make hole 20″ deep.

SLEEVE that anchors pole in ground is 16″ length of galvanized pipe with 2″ inner diameter. Before installing it in the hole, tie paper caps on both ends to keep dirt from clogging the pipe while you fill in the hole around it.



HOLD THE SLEEVE VERTICAL while the hole is filled halfway to surface with rocks and dirt. Sleeve rests on 4″ of this fill packed hard into bottom of hole. Before finishing, put level across sleeve top to make sure that it isn't cocked.



What It Costs

Tetherball; 7′ #7 sashcord....$	8.95
11½′ pipe, 1½″ inside diameter	5.52
16″ pipe, 2″ inside diameter....	.93
Ready-mix cement, sand.....	.75
Swivel harness snap.....	.35
4′ steel-coil chain, ½″ links....	.26
½″-by-4″ cadmium-plated eyebolt.....	.12
Two zinc-plated S hooks, 1¾″ long.....	.10
	$16.98

Prices are those prevailing in Southern California

How to Play Tetherball

Draw straws for first server.

One player stands in each playing zone. Both face same direction, shoulders toward the pole.

Server tosses ball in air, hits it with hand or fist in direction he chooses. Opponent may not strike ball on first swing around pole. Second time, he hits it back in opposite direction. As ball swings back and forth, each player tries to hit it so that rope winds completely around pole in his direction. Game is won by player who succeeds in this or whose opponent forfeits the game by a foul. Winning four games wins set.

These fouls cost you a game:

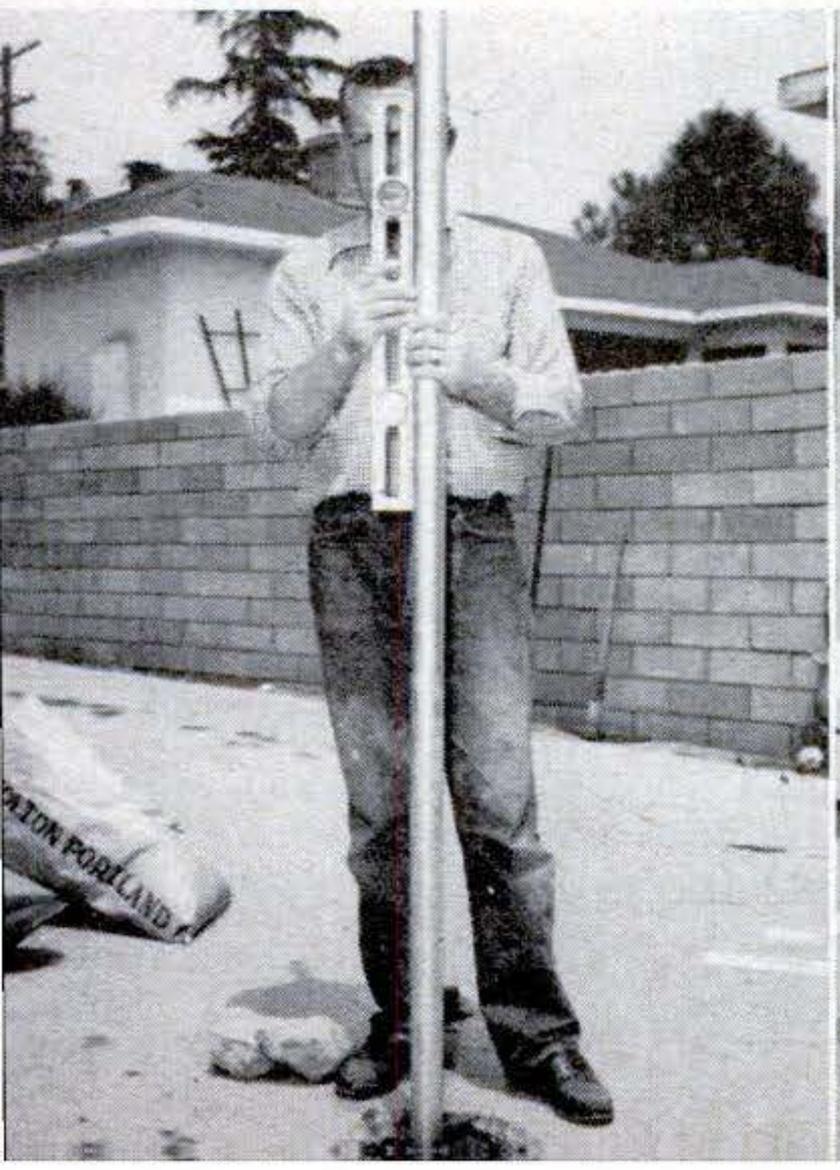
- Hitting ball with any part of body other than hands or forearms.
- Catching or holding ball during play.
- Touching pole.
- Hitting rope with forearm or hands.
- Playing ball while outside playing zone.
- Stepping on or across neutral-zone lines.
- Throwing the ball.
- Winding ball around pole below 5′ mark.

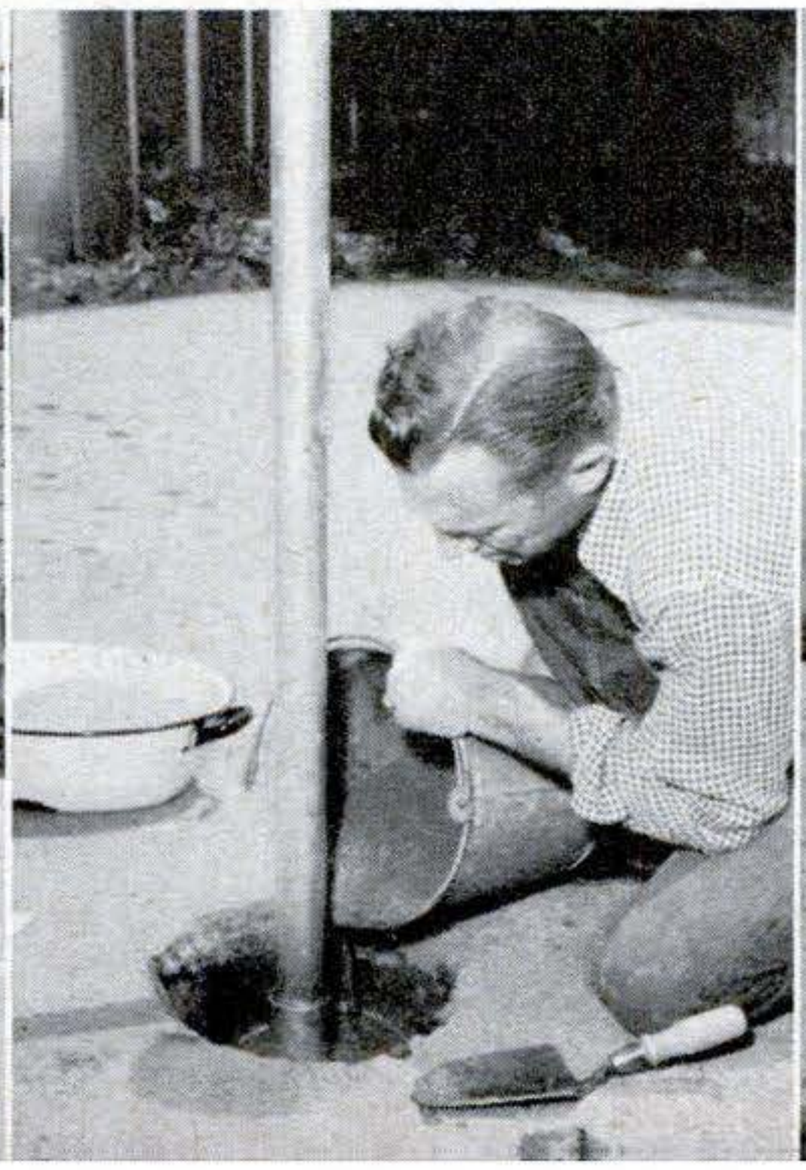
After opening game, winner of previous game serves.

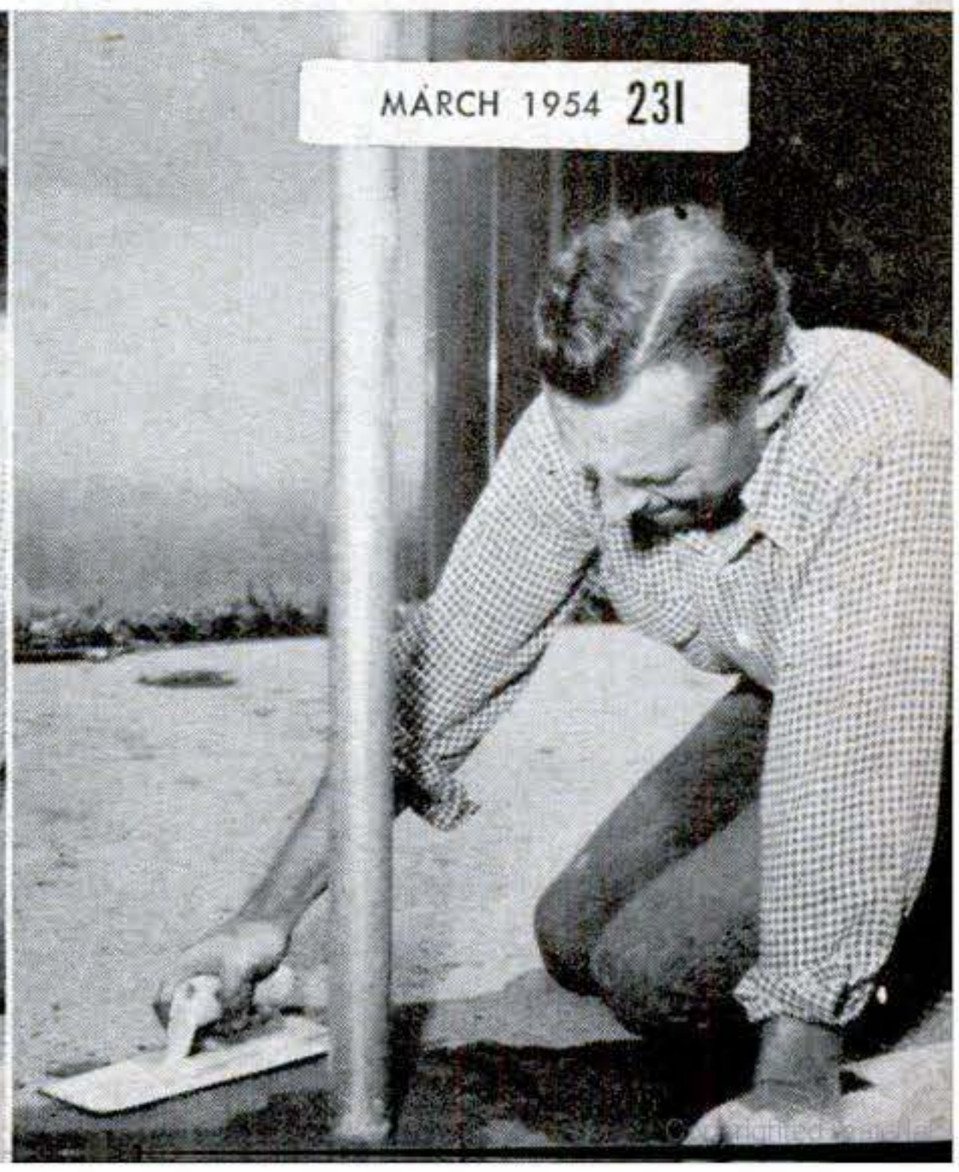
VERTICAL ALIGNMENT of pole resting in sleeve should be checked before concrete is poured to seal hole. Pole is 11½′ length of galvanized pipe. Chain for ball line is fastened 2″ below upper end of pole, 10′ above court.

POUR CEMENT after drenching the dirt and rocks in hole to pack them down. A good mix to seal hole is one part cement, three parts sand, four small rocks. First mix the materials dry, then mix again after adding water.

SMOOTH SURFACE of cement even with surrounding pavement. Be sure top of sleeve is flush so you don't trip over it when pole is stowed away. It's a good idea to close open end of empty sleeve with a cap or plug to keep out rain.







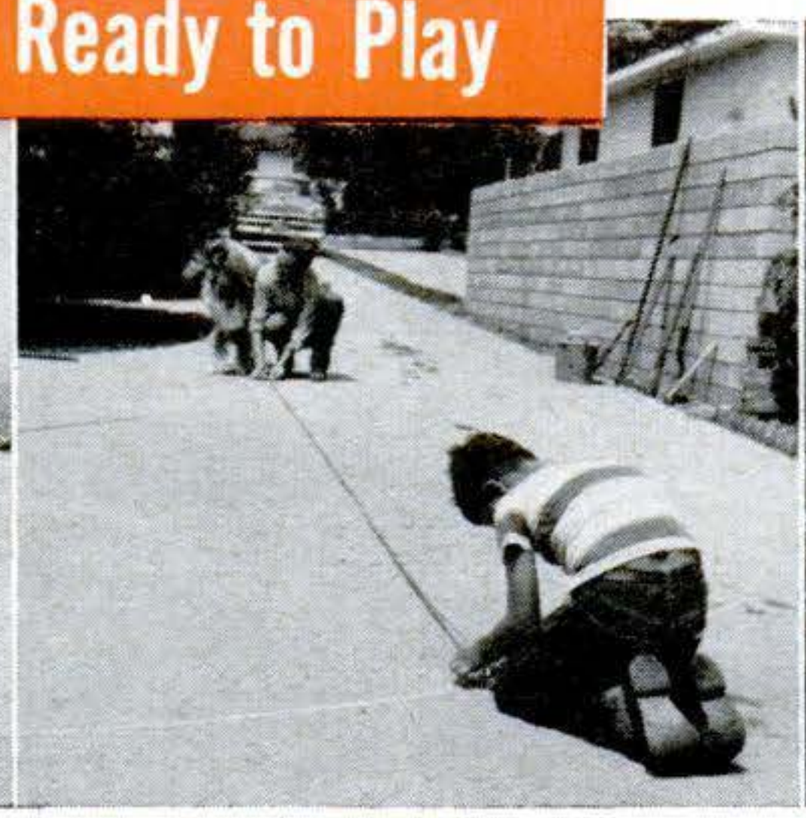
not in use. However, many players don't bother with this but hitch the ball permanently to the pole.

Galvanized steel pipe is recommended for the pole, both for appearance and resistance to rust. If you want to cut costs, however, regular black-iron pipe is a little cheaper and will do the job. Wooden poles are not strong enough, and may break during a game. If there's playing room, you may be able to plant your tetherball pole in the same hole your wife uses for her umbrella clothes drier.

Tetherball is a good way to keep kids in the yard—the ball can't be hit out into dangerous streets. If Junior challenges you, don't take your victory for granted because it looks like an easy game. You will find yourself running hard if you want to win.—*Andrew R. Boone.*

Getting Ready to Play

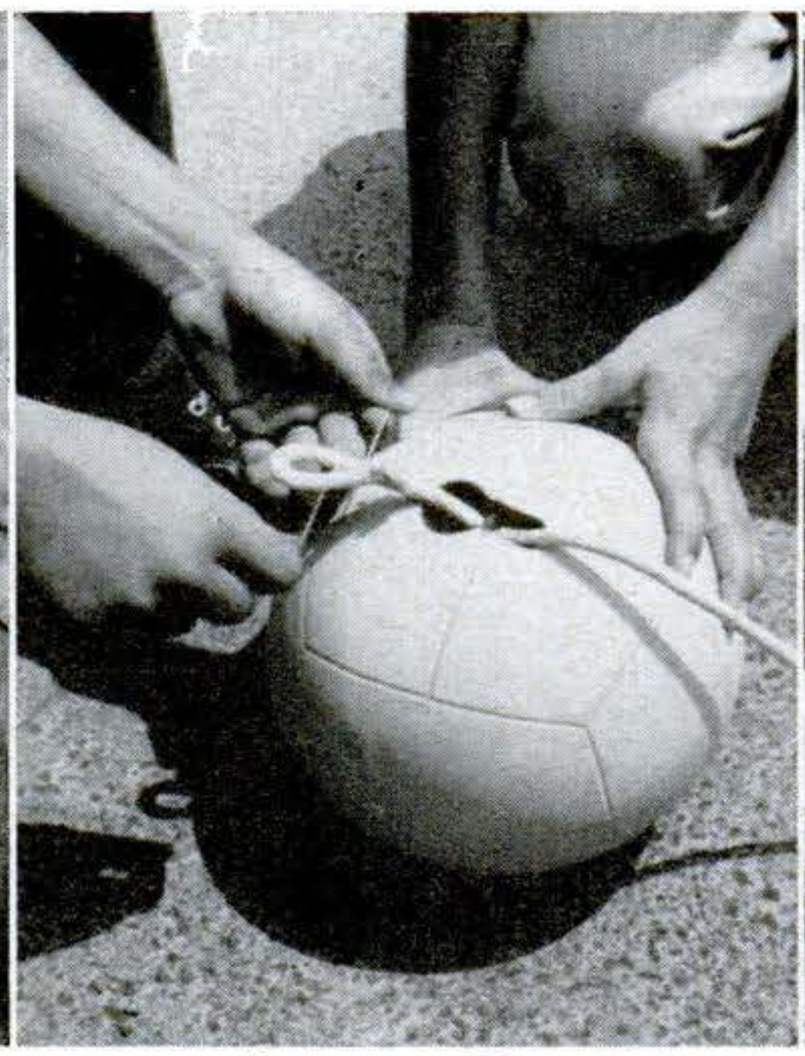
NOW LAY OUT THE COURT. Start by tying a 10′ string to the pole and using it to chalk a 20′-diameter circle on the pavement. The lines can be painted on for permanence. Courts can also be built on grass, asphalt, hard dirt.



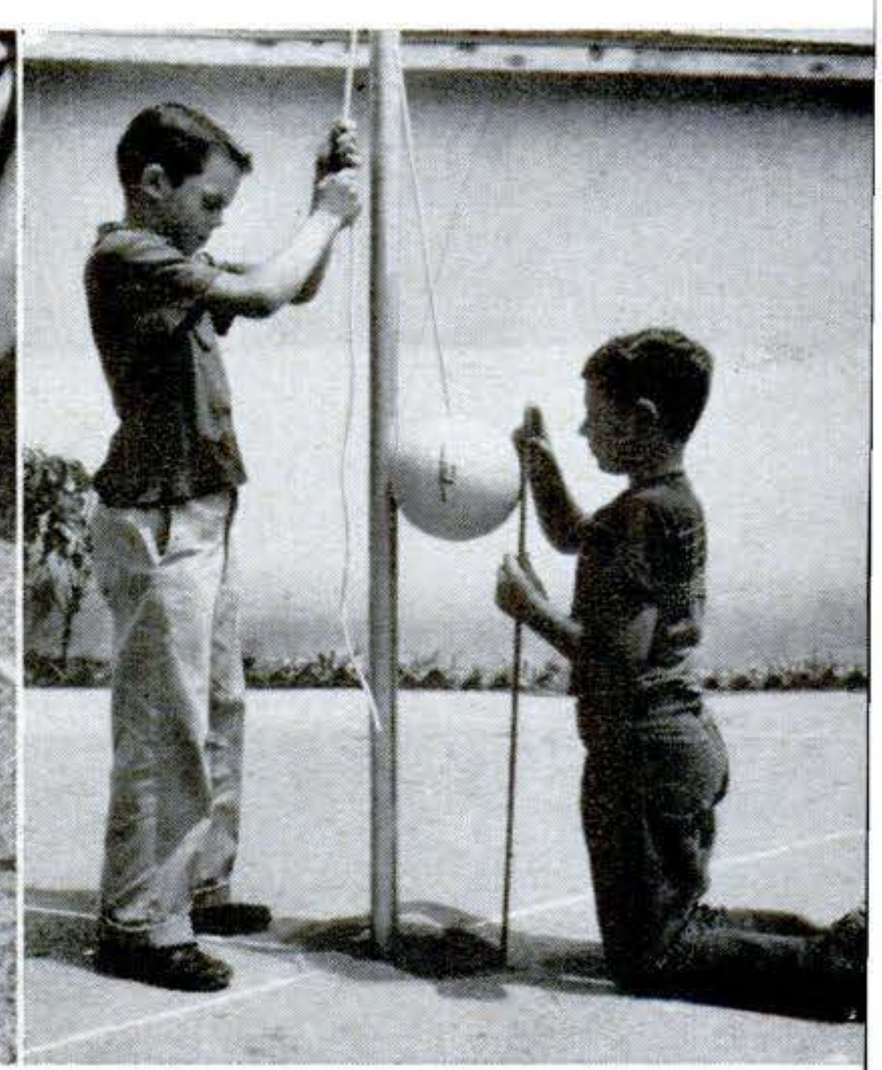
NEUTRAL ZONES are next marked off. Start by finding any two points on the circumference of the circle that are just 17′4″ apart on a straight line. From these points draw lines through the center to the opposite side.

DRILL 5/16″ hole through both sides of the pole 2″ from upper end. Punching guide points first will help. Then insert and tighten an eyebolt to hold the ball chain. Cut off bolt flush with its nut or it may catch the chain.

FASTEN THE CHAIN to the eyebolt with an S hook and close both ends of the hook with pliers. Another S hook connects the other end of the chain to a harness snap so loop in end of tetherball line can be snapped to chain.



ATTACH line to rubber ball at ring countersunk in surface. After threading line through ring, either loop it back on itself as shown or tie a knot in the end. Pull end down into the indentation so it doesn't stick out.



MEASURE HEIGHT before attaching line to pole chain. For average 10-year-old children, top of ball should be 3′ above playing surface. For older players, bottom of ball should be 3′ from ground. Paint or tape foul mark 5′ up pole.

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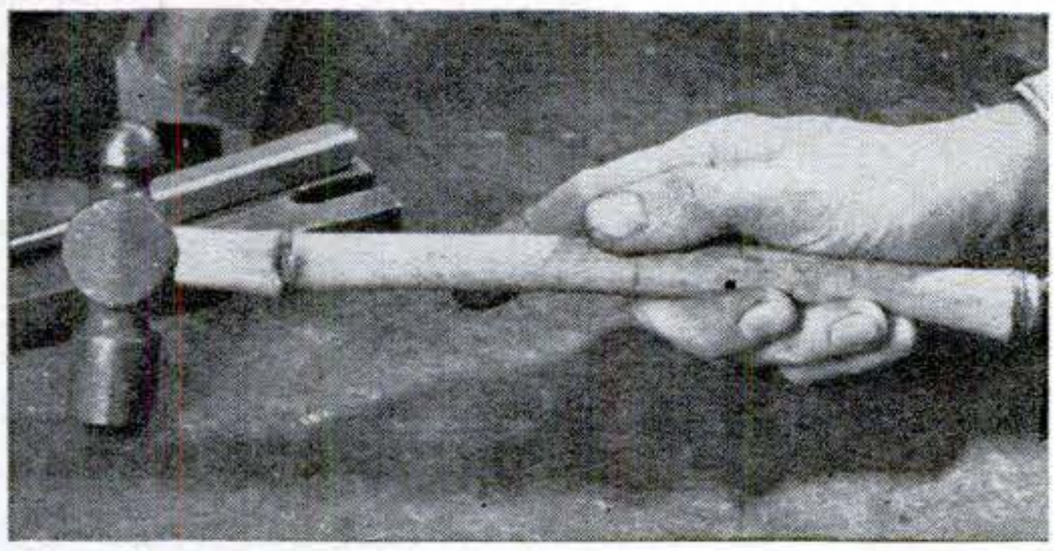
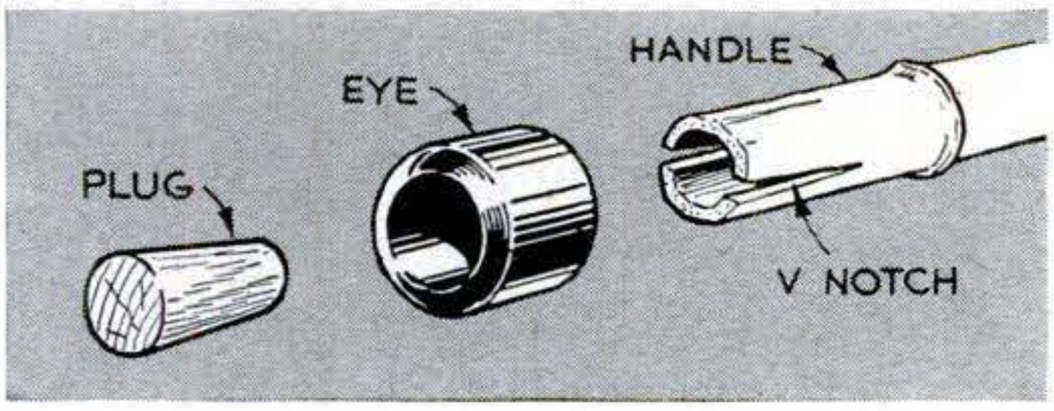


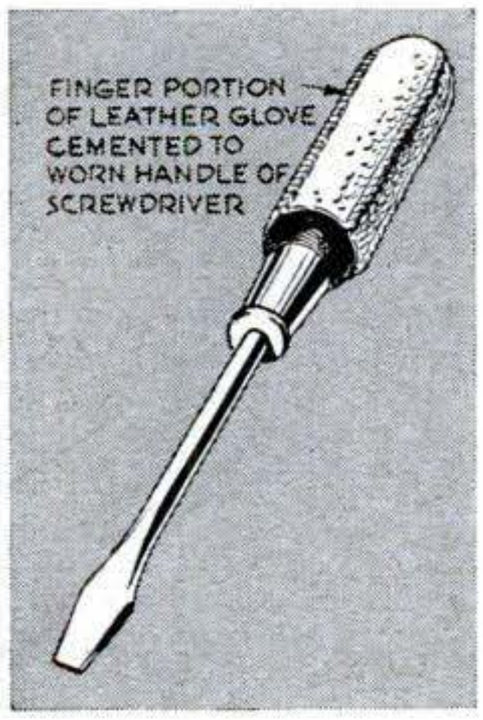
Bamboo Makes Hammer Handle

BAMBOO sections cut from an old fish pole or lawn chair make strong, resilient handles for hammers. Select a portion that makes a tight fit in the eye of the head, or slim down a larger piece by cutting a V notch in the end (below) so the sides can be squeezed together. Do not shave off too much from the outside or you'll weaken the walls. Glue a tapered hardwood plug into the hole in the eye and another in the handle end unless it falls at a joint.—*W. E. Burton, Akron, Ohio.*



Gloves Repair Tool Handles

WORN wooden handles on small tools such as screwdrivers, chisels and files can be quickly repaired by cementing on the finger portions of old leather gloves. The leather covers rough splinters and makes a comfortable, slipproof grip.—*Frank Shore, NYC.*



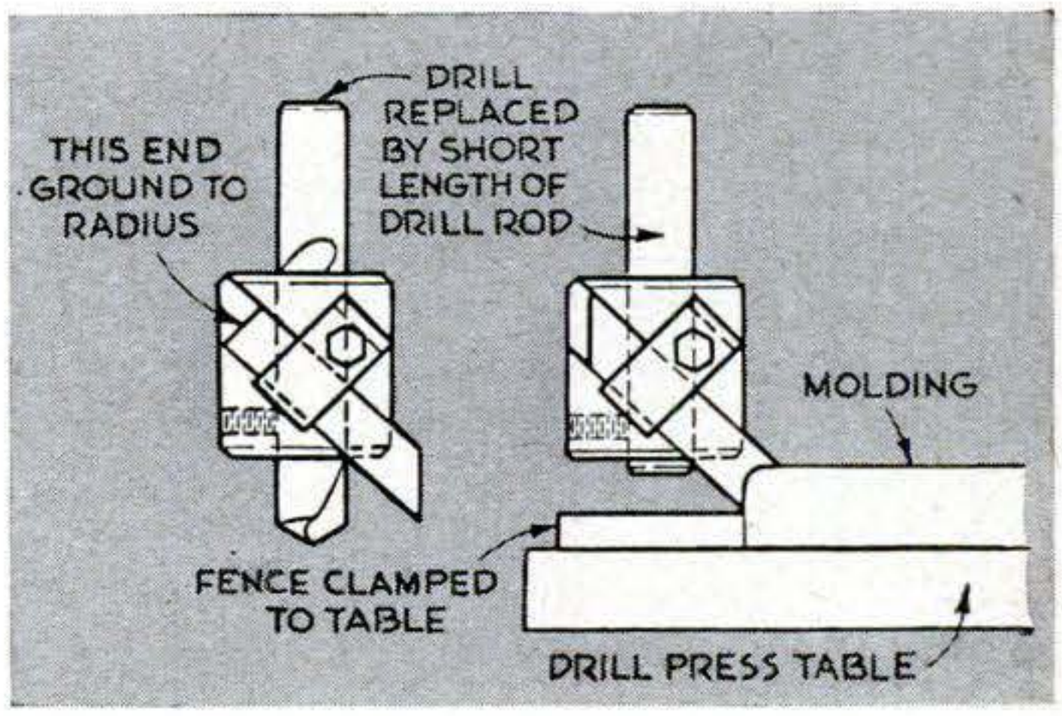
Emery Sharpens Electric Razor

INSTEAD of replacing cutterheads when your electric razor pulls or cuts poorly, try honing. Coat the movable cutter with thin oil and sprinkle it with emery powder, 200 grit or finer. Slide it into the outer cutter, pressing it down against the spring-loaded walls. Run the shaver for about two minutes, pressing down the inner cutter every few seconds to redistribute the emery.—*Walter B. Weber, Angola, N. Y.*

Chain Warns of Hidden Stairs

DOORS that open directly onto a stairway can be deathtraps to persons unfamiliar with a house. A short chain that allows the door to be opened only a foot or two forces visitors to look before they step. Fasten the chain to a screw eye on the door, but hook it to the frame so it can be lifted off.—*Hi Sibley, Nuevo, Calif.*

Circle Cutter Shapes Molding



A SHEET-METAL hole cutter can be pressed into service as a wood shaper to cut any molding shape that can be ground in its cutter bit. Replace the pilot drill with a length of drill rod of the same diameter and just long enough to be chucked in the drill press. Grind the end of the cutter bit to the desired shape (in this case a ¼" radius) and set it to the required height in the drill press. Run it at medium-high speed and guide the molding past it by means of a fence clamped to the drill-press table.—*Fred Barker, Ilion, N. Y.*

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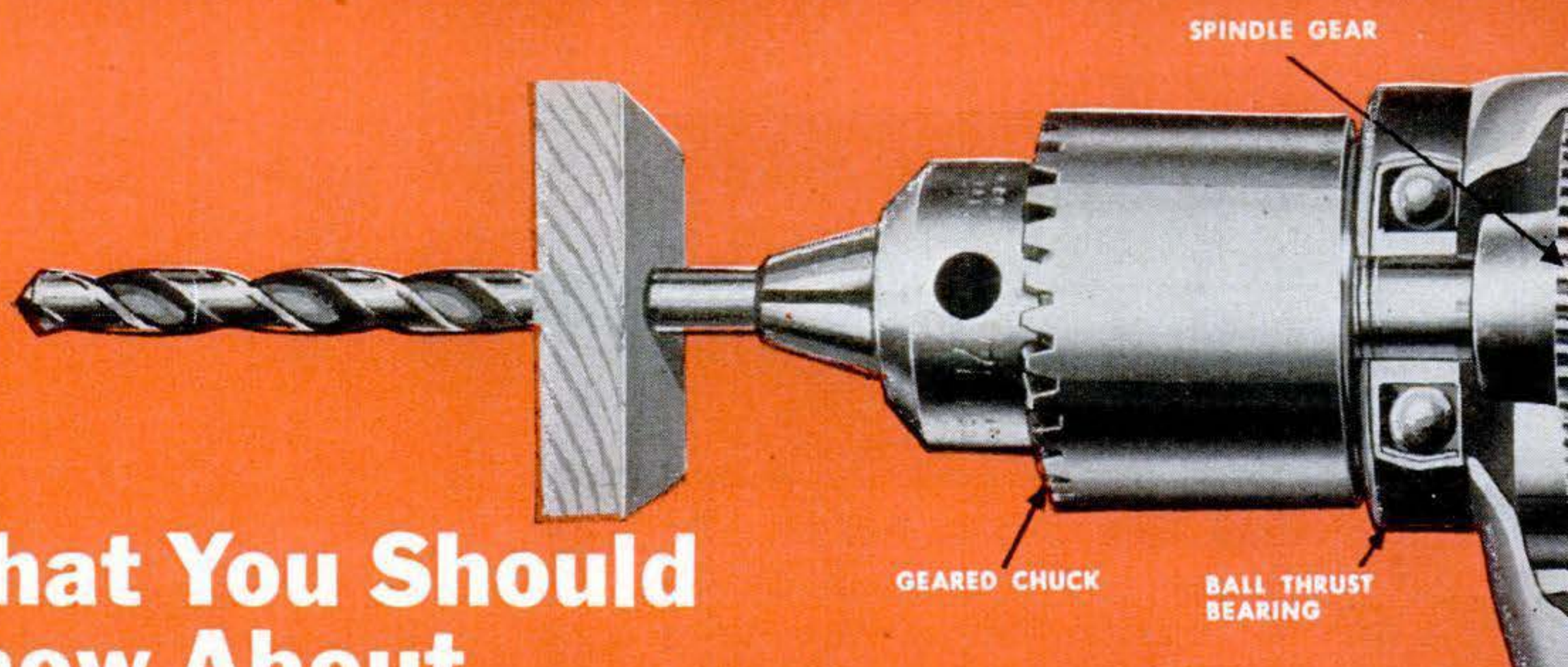

What You Should Know About Buying an Electric Drill

Selected and used with care, this versatile power tool will be one of your prized possessions. Here's what to look for.

By Elbert Robberson

A MOTORIZED shop you can hold in your hand—that's the electric hand drill today. Originally, it was just a tool for drilling holes without tiring your hands. Now it has attachments for doing just about any job you might want to do. But you may not be able to do anything *well* if you get an impractical combination—and you may ruin the drill.

To make a good choice, the first thing to decide is: "Just why do I need a drill in the first place?"

If cash is limited, and you only want to drill a hole occasionally, you can do just as well with a hurdy-gurdy that turns by hand. But if you want to drill a good many holes, or even a few that must be finished quickly and easily, motorize! Bear in mind, nevertheless, that regardless of the other work an electric drill can be made to perform, it is basically a *drill* and should be judged as such.

Compare the specifications of different drills before you buy. One drill will put a lot of beef into a slow all-day pull. Another will spin a small tool at terrific speed. One may have a handle, while many are simply cradled in the hand. They balance differently. Any of the designs may be the best in the world—*if you want to do the kind of work the drill was designed for.*

This depends primarily on what kind of holes you need. For small ones in metal, a fluted bit can turn about 2,000 r.p.m., while such speed in thermoplastic could melt a ragged crater. Large holes in metal call for a slow-turning spindle—1,000 r.p.m. or less. A hole saw that will put a neat 1″ hole through a steel plate at a well-oiled 500 r.p.m. might chatter itself to pieces at 2,000.

On the other hand, a fast-turning flathead wood auger (simply a cutting edge on the end of a rod, with the usual spiral fluting omitted to reduce friction) will push a clean 1″ hole through a board in a hurry. At low speed, it will just chew up splinters.

Because of this, the average ¼″ electric hand drill is designed to do a little of everything. If you are a specialist, get a special drill. For instance, in auto-chassis or structural work, the ⅜″ or ½″ tool would be best, even though the heavier construction and more powerful motor cost more. These drills

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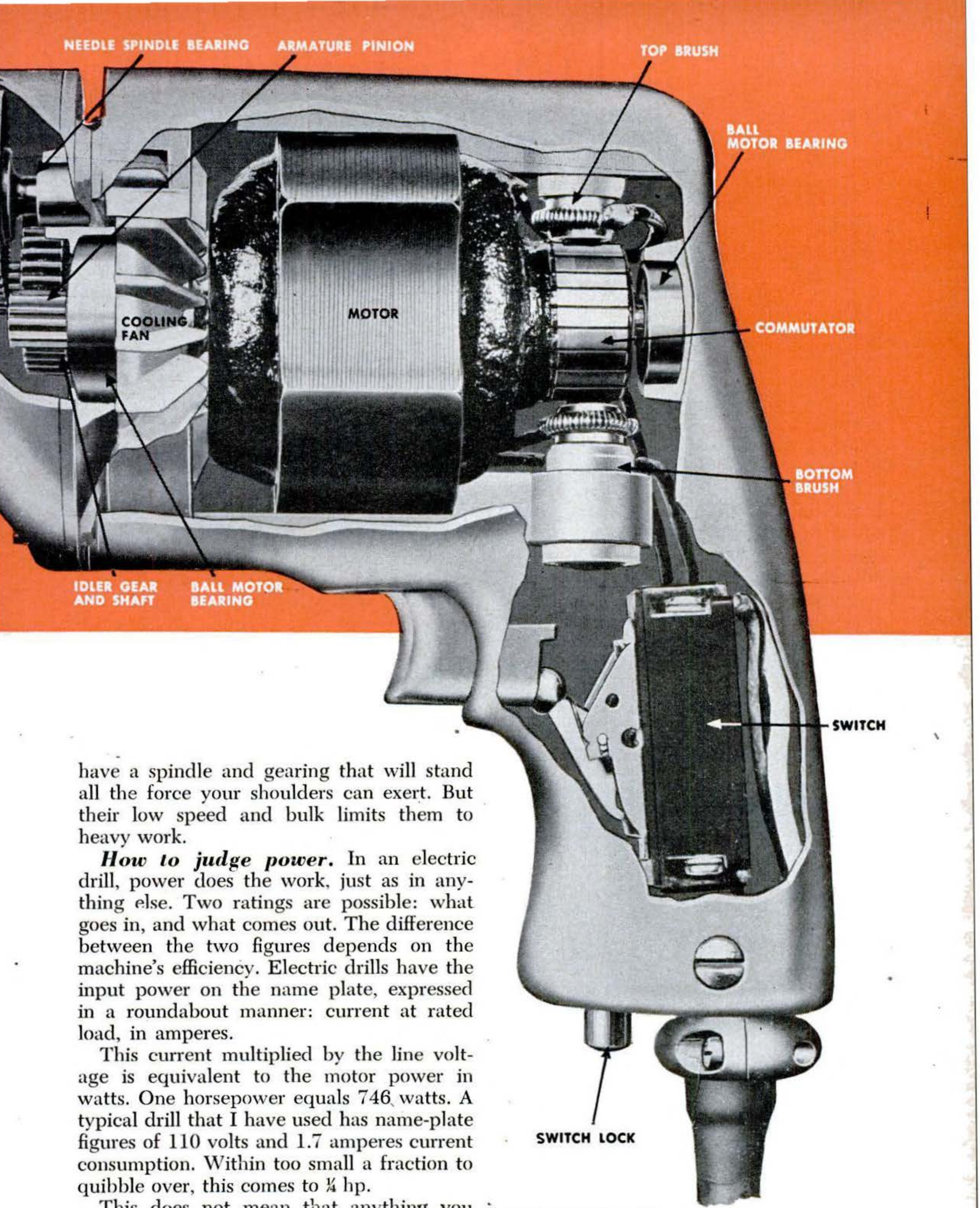

WHAT'S INSIDE? The manufacturer's literature usually will tip you off to such important features as the type of bearings. In the above lightweight drill, note that motor rides on ball bearings while the chuck spindle has a heavy ball-thrust bearing and a needle bearing at inner end. Gears reduce motor speed to give torque for heavy pulling.

have a spindle and gearing that will stand all the force your shoulders can exert. But their low speed and bulk limits them to heavy work.

How to judge power. In an electric drill, power does the work, just as in anything else. Two ratings are possible: what goes in, and what comes out. The difference between the two figures depends on the machine's efficiency. Electric drills have the input power on the name plate, expressed in a roundabout manner: current at rated load, in amperes.

This current multiplied by the line voltage is equivalent to the motor power in watts. One horsepower equals 746 watts. A typical drill that I have used has name-plate figures of 110 volts and 1.7 amperes current consumption. Within too small a fraction to quibble over, this comes to ¼ hp.

This does not mean that anything you chuck up is going to be spun with the force of one leg and shoulder of old Dobbin—and it is good that it doesn't. Indeed, anyone trying to hold an actual quarter-horsepower in the offhand manner we are accustomed to use with hand tools would get his arm

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twisted off before he could hit the "off" button.

The figure actually means that this machine will convert ¼ hp. of electrical energy into a rotary mechanical force, with a little loss here and there. By the time these losses are added up, the drill chuck ends up with about 1/32 hp. This is the power we have to work with. With no more than about 25 percent of the power that goes into the electrical line cord showing up at the cutting edge of the tool, it is apparent that, unless you simply want to dabble, a powerful motor is a *must*. The limit in this direction is dictated by cost, and by the weight you are willing to heft.

Now, how about speed? The figure on the name plate *may* be the speed at which the tool works, but it is more likely to be the free-running value. The working speed is about two-thirds of this. Therefore, unless otherwise specified, a name-plate figure of 1,800 r.p.m. should be taken to mean a spindle speed of 1,200 when the tool starts taking a bite.

If you intend using the drill for a number of different applications, compromise is necessary. This should favor the basic use. Thus, the speed will be off only for the less important functions.

For instance, if running a countersink is an important part of your jobs, don't buy one of the small high-speed whirligigs. It would chatter worse than a roller skate on a boardwalk. Get a medium-speed tool. On the other hand, for freehand wood turning, get the fastest.

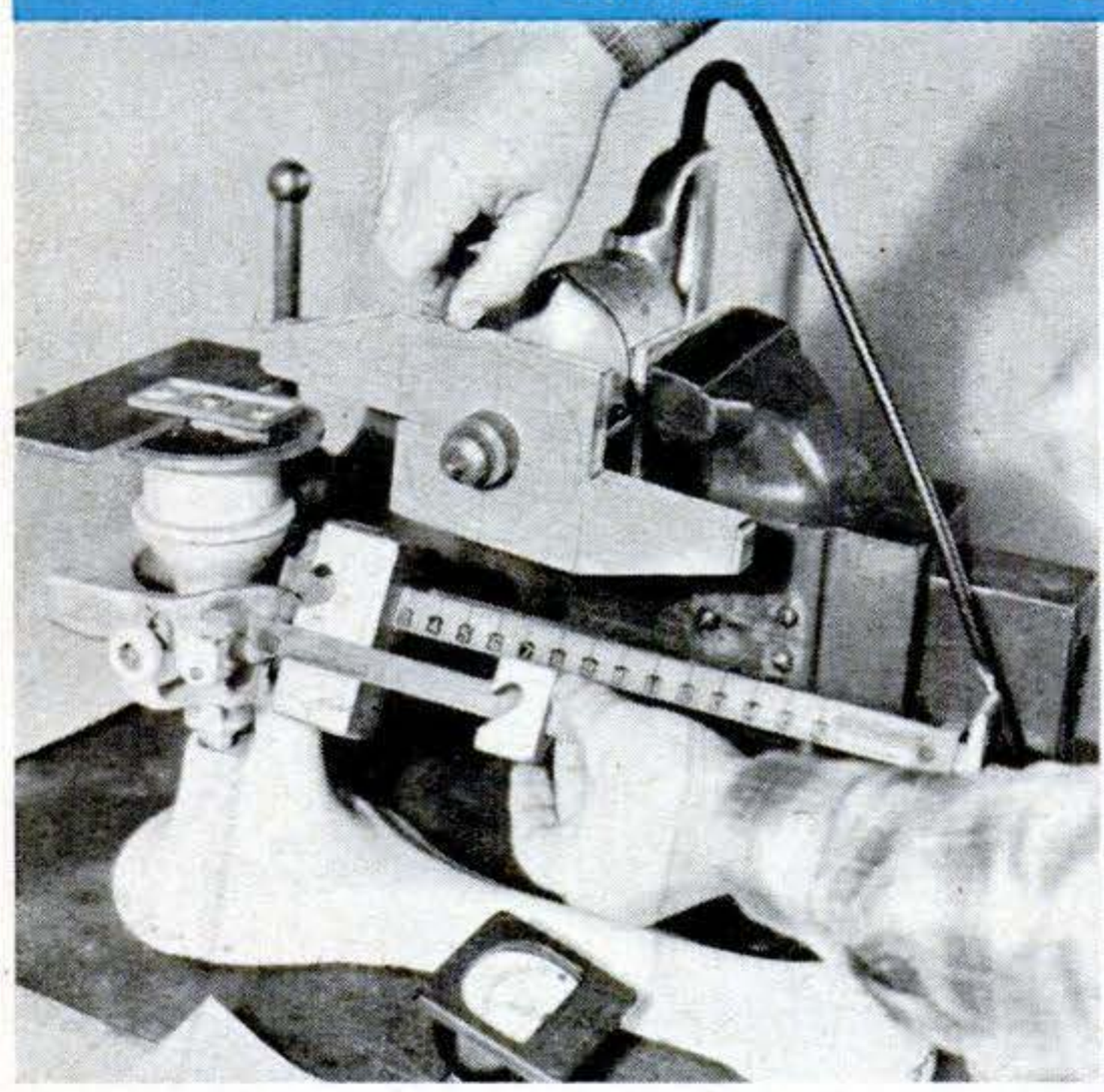
Build is important, too. In addition to having the right power and speed, the drill must have a suitable build for the job. If it is to be hand-held for jobs like buffing or sanding, you'll be happier if the handle attaches at the center of gravity. If putting holes in restricted spaces is your problem, you might find a drill having an integral angle head to be as valuable as the same weight of uranium.

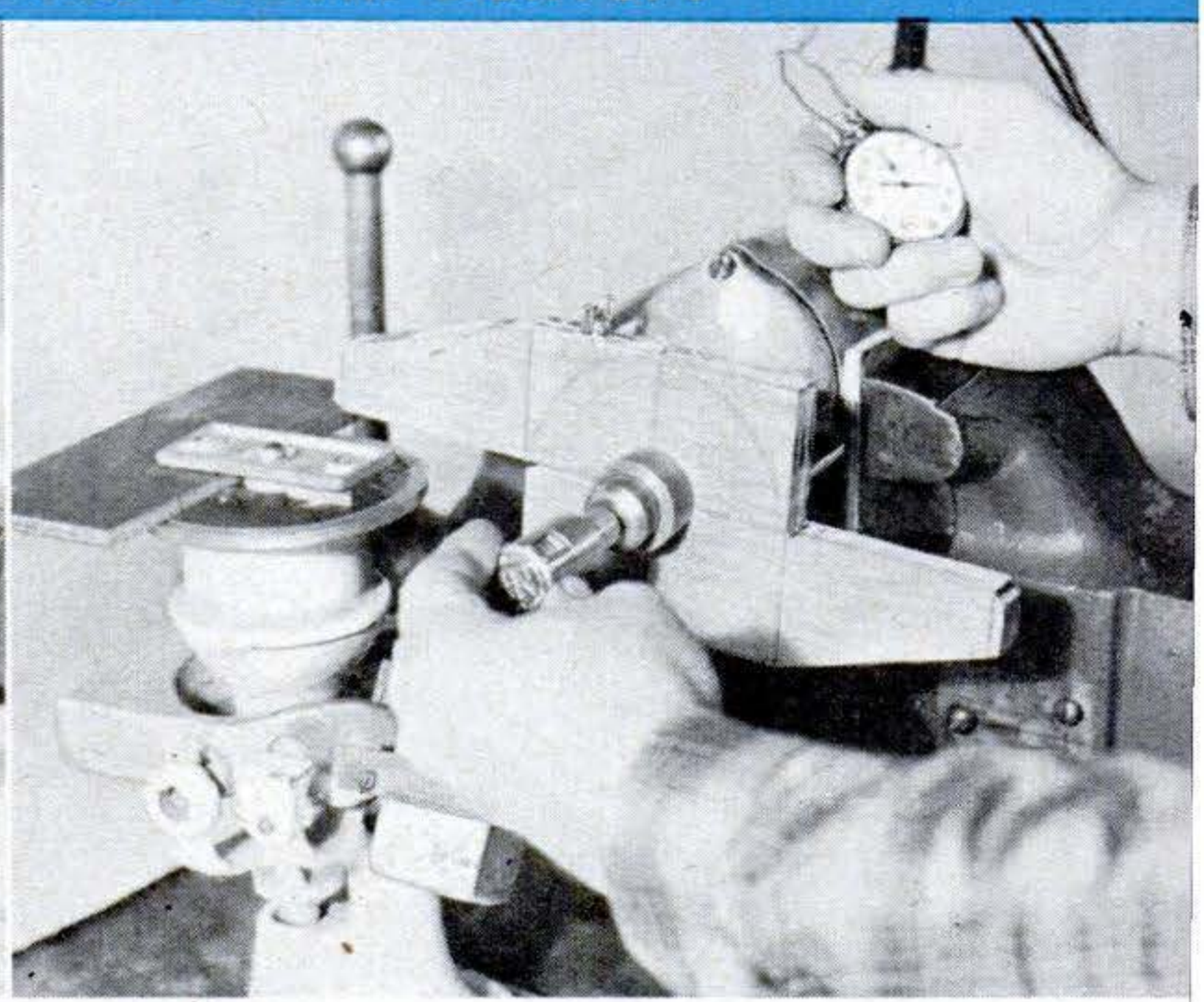
In a typical drill of good mechanical design, a gear train consisting of the armature pinion, an idler and the spindle gear reduces the motor speed (of 15,000 to 20,000 r.p.m.) and provides torque for heavy pulling.

Besides governing the spindle speed and torque, gearbox design also controls the bulk of the nose end and its ability to work in corners or close to perpendicular surfaces. Drills having a large spindle gear driven directly by the armature pinion have a bulkier shape for the same speed and power.

Lighter drills use sleeve bearings for both motor and chuck spindle, with a small ball-

What Power Does a Drill Deliver?





TEST SETUP, a homemade Prony brake, measures power at chuck. Writer built it to determine efficiencies of drills at converting electricity to power. Above, friction brake is tightened until ammeter shows motor is drawing rated name-plate current. Scale shows torque and rev counter shows speed. These values, with known length of torque arm, can be substituted in standard horsepower equation to show drill's output. Efficiency—power delivered to current drawn—runs 10-20 percent on most small drills.

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type thrust bearing. A home or hobby tool *used only for drilling* will do perfectly well with such an inexpensive lineup, provided the bearings get all the care specified by the manufacturer. But, ball or roller bearings and a long spindle are a *must* for extensive work involving side thrust. Comparative spindle length can be judged by the length of the "nose" or gear housing.

Three types of chucks. Like the spindle bearings, the choice of chuck depends upon the treatment it will get. The simple hand-tightened chuck is designed for economy, but it will take all the punishment the operator's hands or the motor can muster in straight, small-diameter drilling. Any bending force or a heavy unbalanced load, however, may eventually make it too splay-jawed to grip firmly or run true.

A second type, used on intermediately priced drills, is tightened with a hexagonal wrench, and has enough grip to turn a harder-working tool, and the guts to withstand a small radial thrust.

But the only chuck which will stand up to continued heavy cutting, or the abuse of unbalanced or side loading is the geared type, tightened with a toothed key.

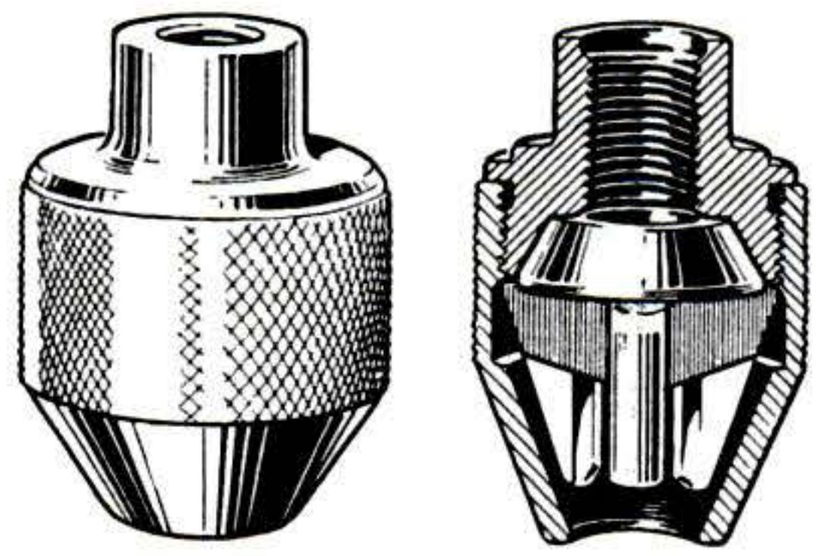
Which, quite naturally, leads into the subject of electric-drill tools and attachments. Many are perfectly reasonable applications of the electric drill's tool-turning capability. But even the drill manufacturers waver on the point of what an electric drill can reasonably be expected to do.

How to analyze accessories. If we analyze the various accessories according to good mechanical practice, there is a logical pattern. One complete family of tools and attachments has blanket approval: the twist drill and its cutaway descendants. Small end grinders, rotary files, hole saws, paint stirrers, plug cutters—all things that do their work in the direction the drill is pointed—can be used with any electric drill.

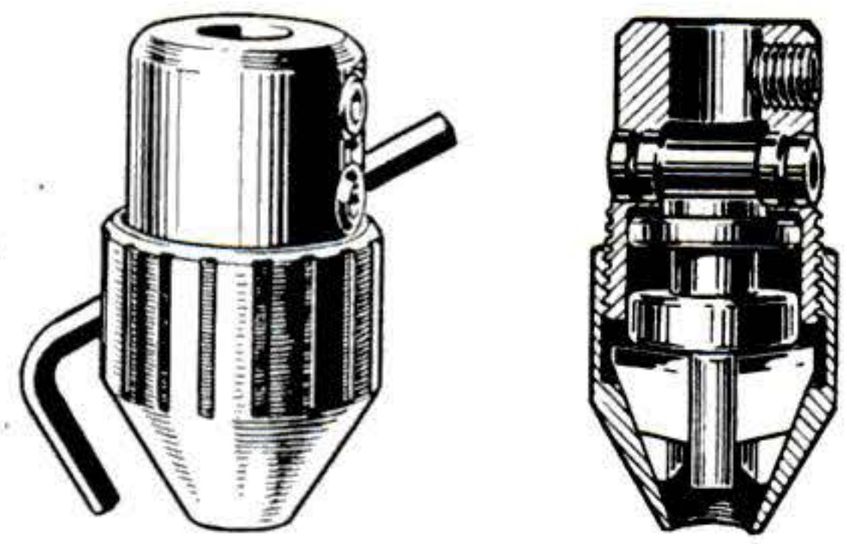
Clutches, torque converters, speed-changing or reversing gears to aid in screwdriving, tapping or drilling are all reasonable attachments. As long as it does not extend out so far that it exerts a bending force, any tool which is put to work by the application of pressure in line with the spindle is perfectly safe.

Another useful hand-drill accessory is the drill-press stand. This permits the drilling of truly perpendicular holes, and the safe application of more force than would be wise holding the tool in hand. But, since these stands are operated by a lever capable of exerting considerable thrust, care must be taken not to overload the tool. Also, realize that because of their inexpensive construction, these are not precision-boring machines. Nor does a stand give a drill the ability to withstand forces it was not designed for. For instance, some attachments like routers, planers and shapers do all right in a conventional drill press. But a light

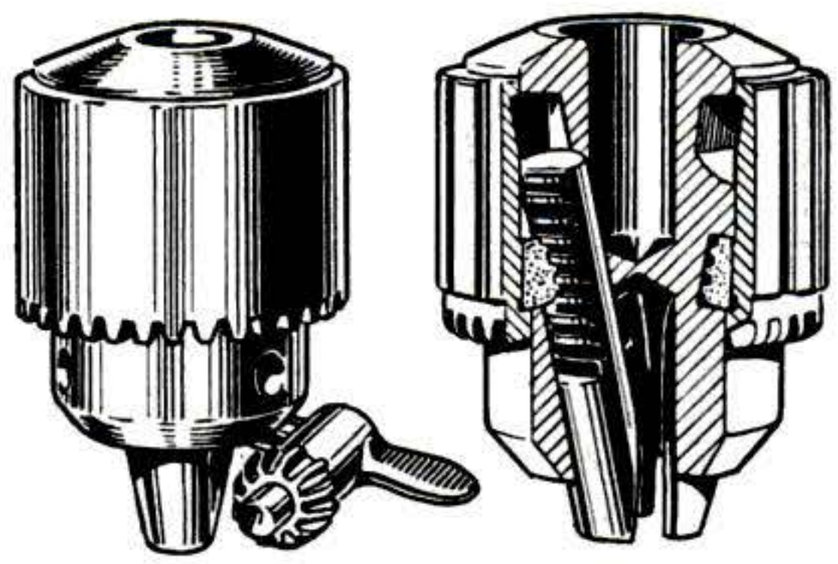
Types of Chucks



HAND CHUCK is tightened by twisting. Designed for economy, it is most suitable for straight-line work.



HEX-KEY CHUCK is commonly found on drills in middle price range. A hexagonal wrench tightens it.



GEARED CHUCK is best for all-around use. You adjust it by using a separate toothed key like one shown.

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electric drill, no matter what kind of a stand it is clamped in, isn't built for this kind of duty.

Rim- or face-working accessories. When a tool or attachment puts high side loads on the spindle of a light drill, the results may be disappointing. If you compare an attachment where a circular-saw blade is directly chucked with even an inexpensive table saw, you'll see that the latter has all the best of it. The table saw has heavy, well-spaced bearings and plenty of power to work the blade at high peripheral speed. For occasional use, of course, the drill attachment will suffice. But for frequent, prolonged or precise work, a tool designed for the work is far better.

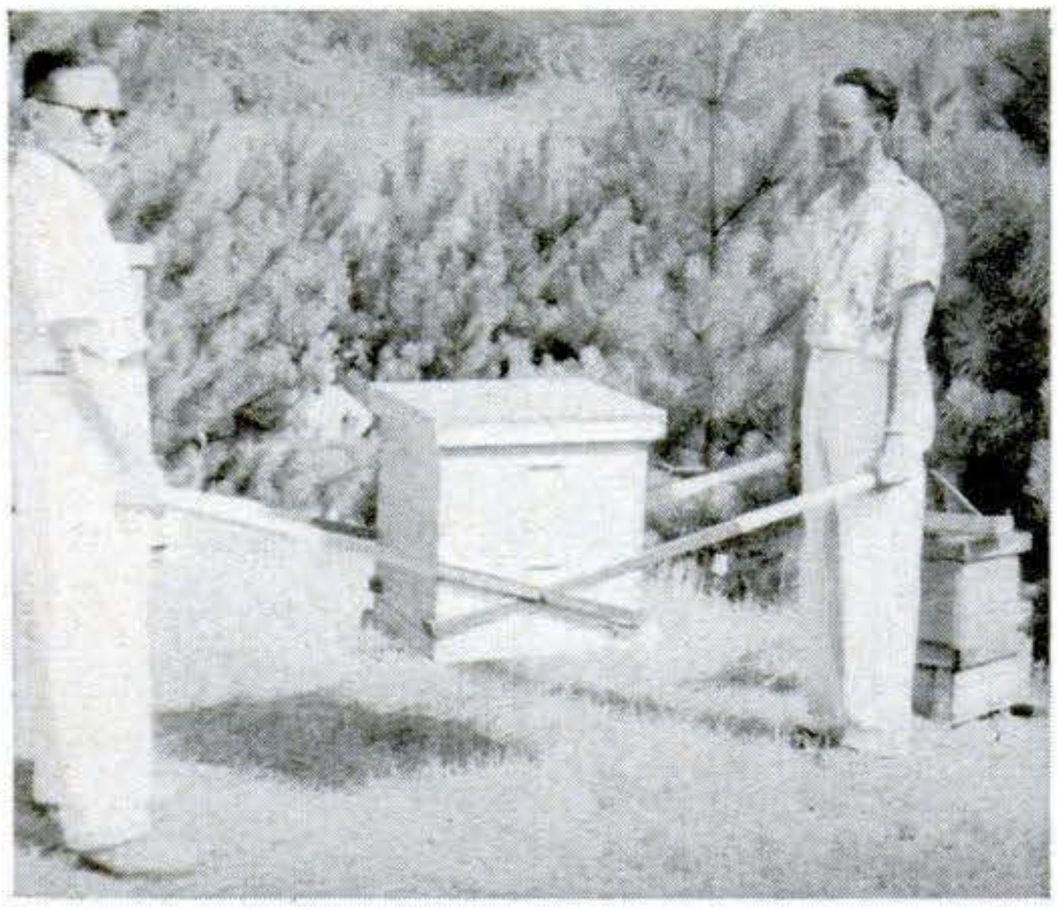
The same is generally true of grinding, sanding and buffing. If you don't mind working at slow surface speeds, and if you take pains not to overheat the drill motor, the drill will handle an occasional job. If your need for a special tool occurs only rarely, it can be argued that buying a cheap drill attachment makes more sense than buying a more costly single-purpose tool. But don't ask or expect too much from the attachment.

Judging attachments. There are whole families of new attachments now available that use a drill solely as a motor to run a quite separate machine tool. Their utility depends to a considerable degree on how they employ the motor. If the attachment frame grips the drill frame rigidly, and asks the spindle to supply only rotary power, it will not cause harm so long as the motor is not overloaded.

If the attachment is secured solely or mainly by chucking, think of it as a lever that may multiply side loading on the spindle bearings very substantially. An attachment that puts a 1-lb. side thrust 6″ ahead of the spindle, for example, can apply very high loads to drill-spindle bearings that are only 1″ apart.

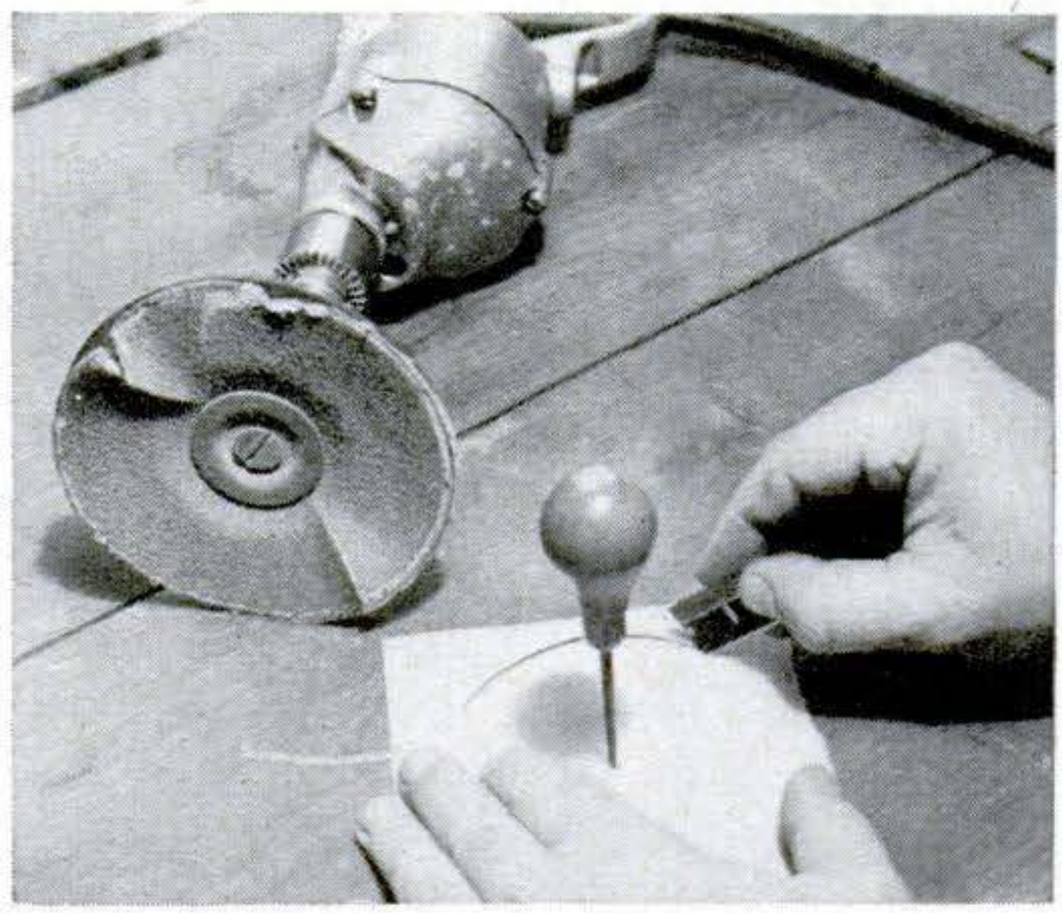
Some makers provide straight cylindrical chucking shanks in their attachments, and others use a shank with three flats for the chuck jaws. The first is less desirable from the point of possible chuck damage if the tool should snag under load. Do not let a chuck slip if you can possibly help it—it will not only chew up the shank but may affect the accuracy of the chuck. END

▶▶▶Every time my dog stuck his nose in his dish it slid away from him. So I cemented a rubber fruit-jar ring on the bottom. Now the dish stays with him down to the last mouthful.—*E. Rehm, Queens Village, N. Y.*



Tongs Lift Beehives Safely

HERE'S a honey of an idea for doing a ticklish job—moving a beehive without getting stung. A couple of pairs of these long-handled tongs let two men pick up a hive without touching it. The tongs are simply 3½′ lengths of strap iron, bent at the tips and bolted together near one end to provide a scissors action. Hose sections slipped over the ends provide hand grips.—*Charles L. Stratton, Hollis, N.H.*



Sanding Disks Cut Quickly

IF YOU'RE caught short of sanding disks, here's an easy way to cut your own without ruining the family scissors. First jab a short, pointed tool into the center of a sandpaper square, then press a razor blade through the paper into the wood beneath at a point equal to the desired radius. Rotating the paper slowly against the blade will then slice out a neat circle.—*Charles Macioci, Port Washington, N.Y.*

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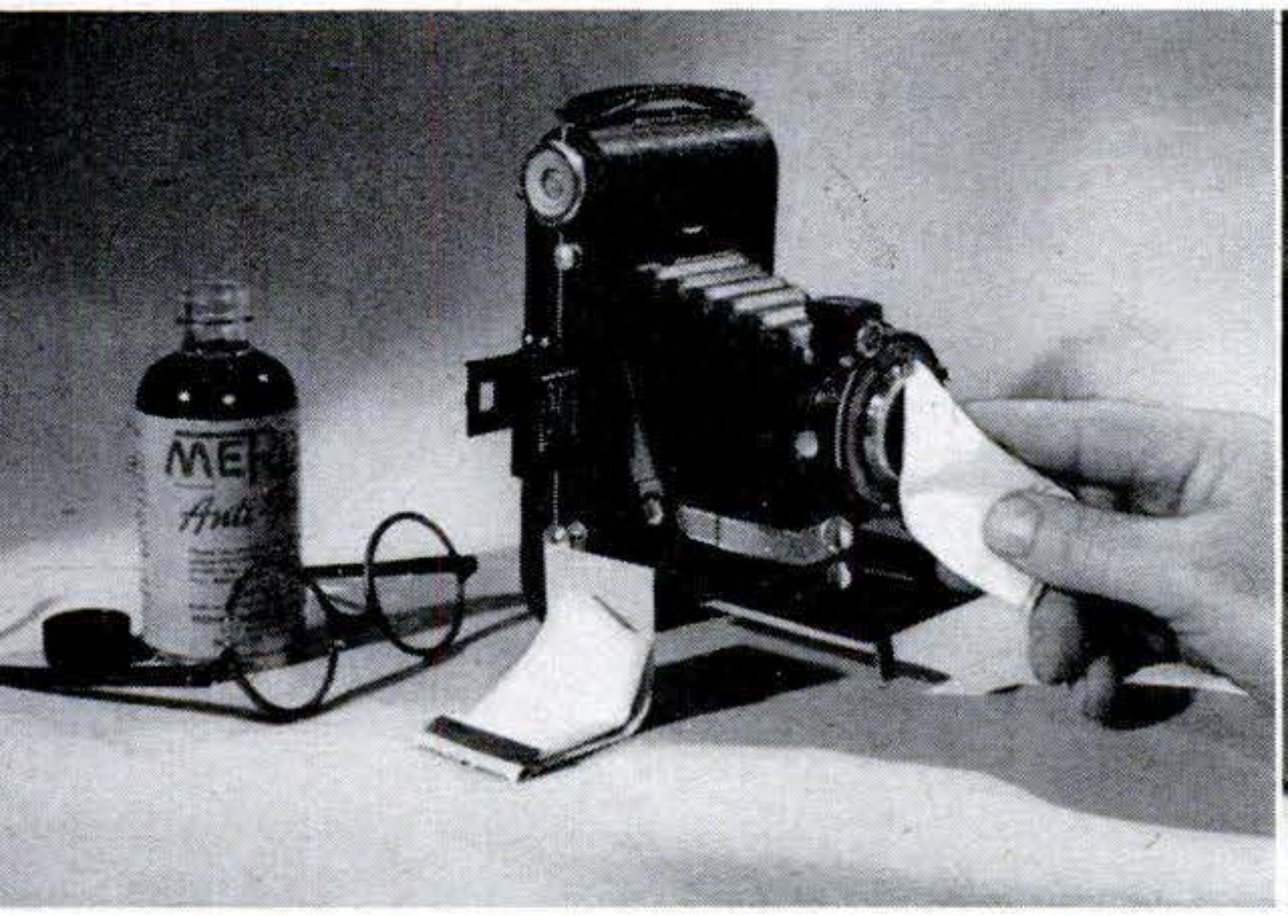
Windows steam up in winter? Specs become blinders when you go inside? Then try a liquid chemical designed for the job of

Keeping Glass from Fogging

By Kenneth Murray

CAR WINDOWS STAY CLEAR if you coat the inside surfaces with a fog-preventing chemical.* Wipe it on, polish lightly and a thin, invisible film remains. Now available in bottles for home use, the liquid has long been used on plane windshields. Cloth tied on the edge of a windshield scraper (above) makes a good applicator for car windows.

**Photos show Anti-Fog, made by Merix Chemical Co., 1021 E. 55th St., Chicago.*



EYEGLASSES AND CAMERA LENSES will not steam up when brought into a warm room if treated first. Moisten a pad of tissue and store it in matchbook cover for use as needed.

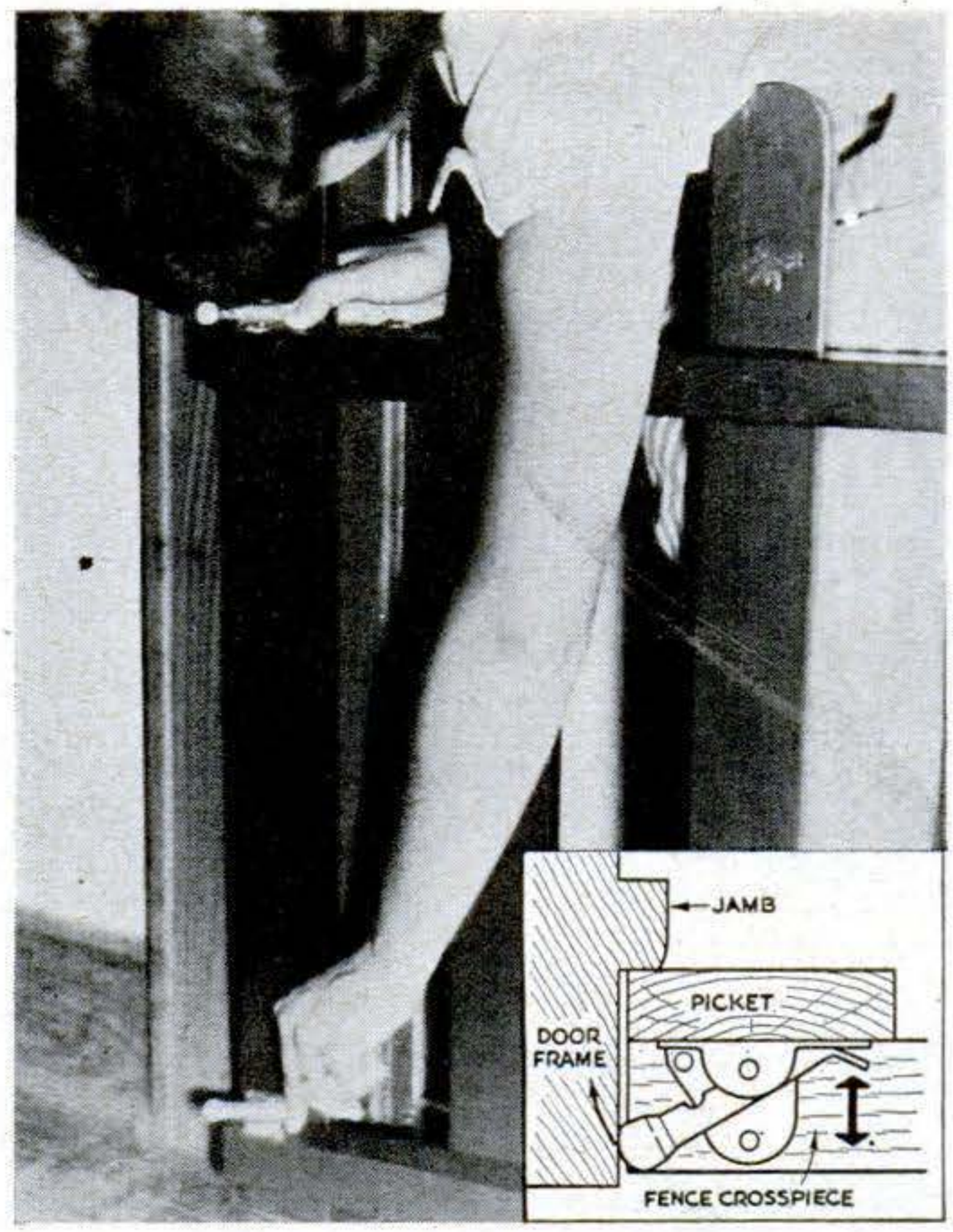
INSIDE FACE MASKS for diving, welding and paint spraying, the chemical keeps glass clear in spite of breath passing over surface. It works on tight-fitting sun goggles too.

USE IT ON HOUSE WINDOWS. They'll stay clean longer because steam won't build up and run down their surfaces, leaving streaks. The chemical also works on clear plastic.

IN THE BATHROOM, it will keep the medicine-chest mirror free from steam while you enjoy a hot shower. Apply it to a shaving mirror as below—and you can breathe all over it.

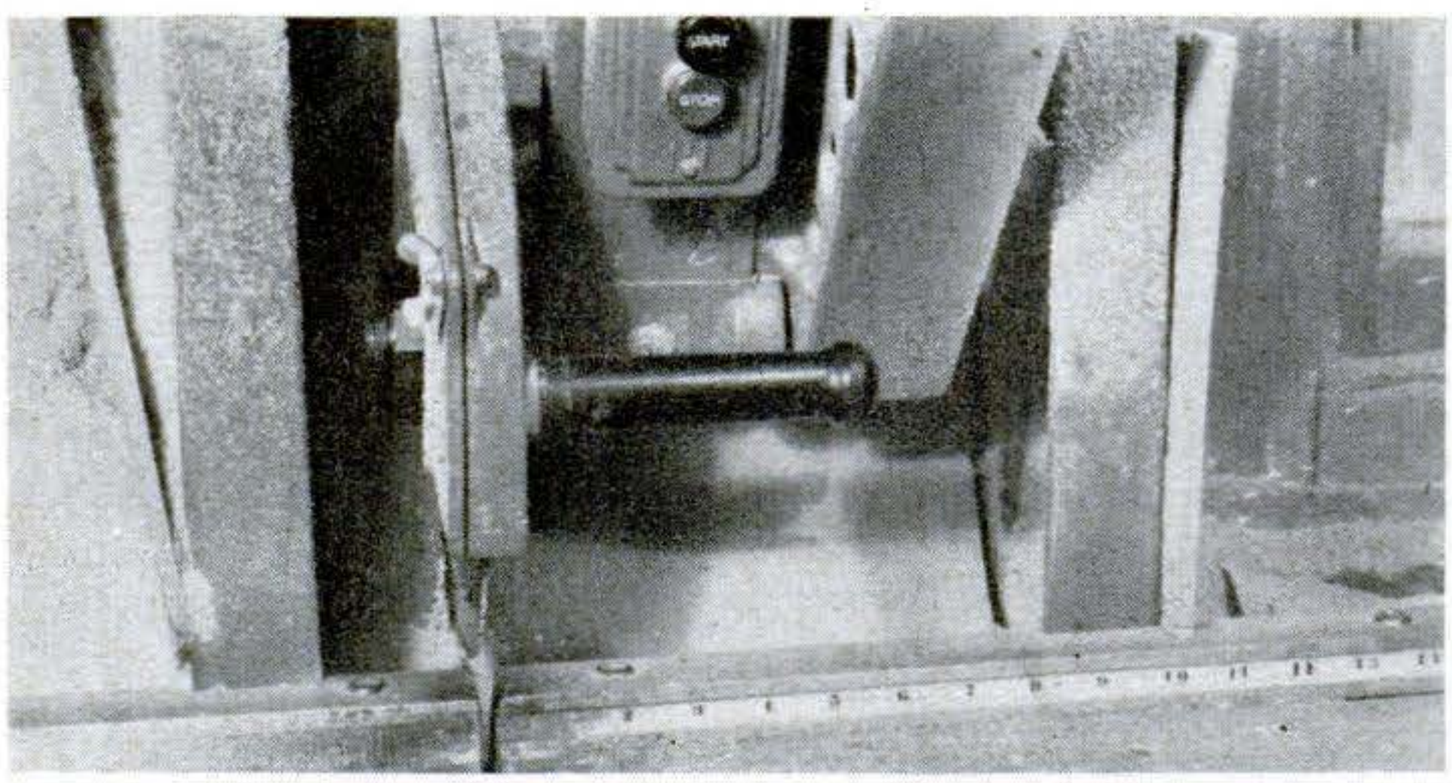
Tile Base Made of Hardboard

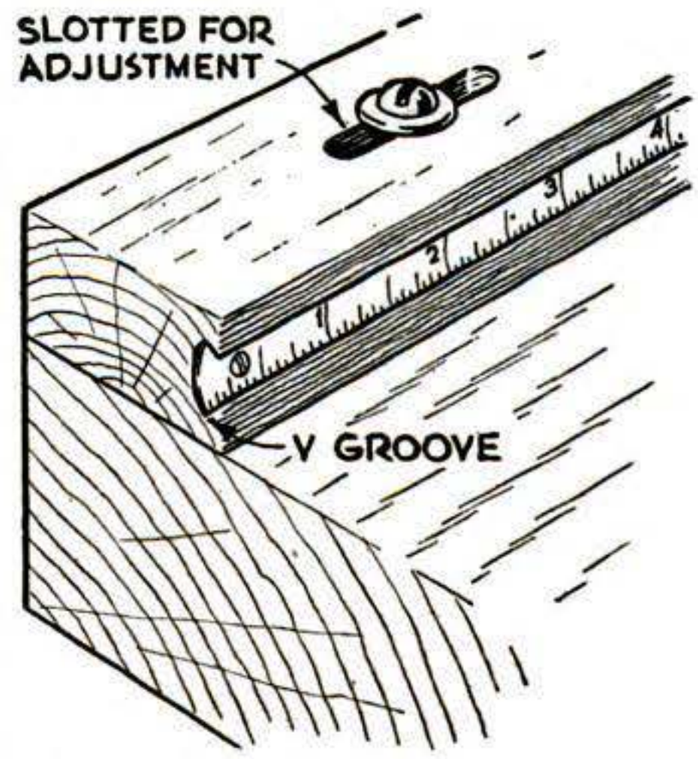
HARDBOARD panels can provide a smooth, flat base for asphalt, cork or rubber floor tile, as well as linoleum or carpeting. Nailed at 6″ intervals, the hardboard is laid with a ⅛″ space between sheets. A felt liner usually follows. Care must be taken to keep the joints between tiles from coming directly over the spaces between panels.



Rubber Tips Hold Baby Fence

SPRING-LOADED catches designed to lock a window open hold this baby fence in a door opening without screws. The rubber tips press outward against the door frame on each side. Built of pine, with 30″ pickets of one-by-threes and a pair of two-by-two crosspieces, the gate is ¼″ less than door width.—*Douglas E. Knight, Endicott, N. Y.*





Flexible Tape Inlaid on Table Lets You Measure as You Saw

TO SAVE time in measuring work you are cutting on your swing saw, mount an inexpensive 6′ or 10′ steel tape in a groove cut in the fence or back edge of your saw table. Then you can just slide your board up to the required dimension on the tape and swing the saw.

Embed the tape in a beveled groove cut in the fence. Cut the groove by passing the fence twice under the saw blade, set at about 30° off vertical; then make successive passes to clean material between the two angle cuts. Slide the tape into the open end of the groove and secure at both ends with wood screws. Elongate the screw holes in the fence to permit slight adjustment of the zero mark when changing blades.—*Michael Ligocki, Gary, Ind.*

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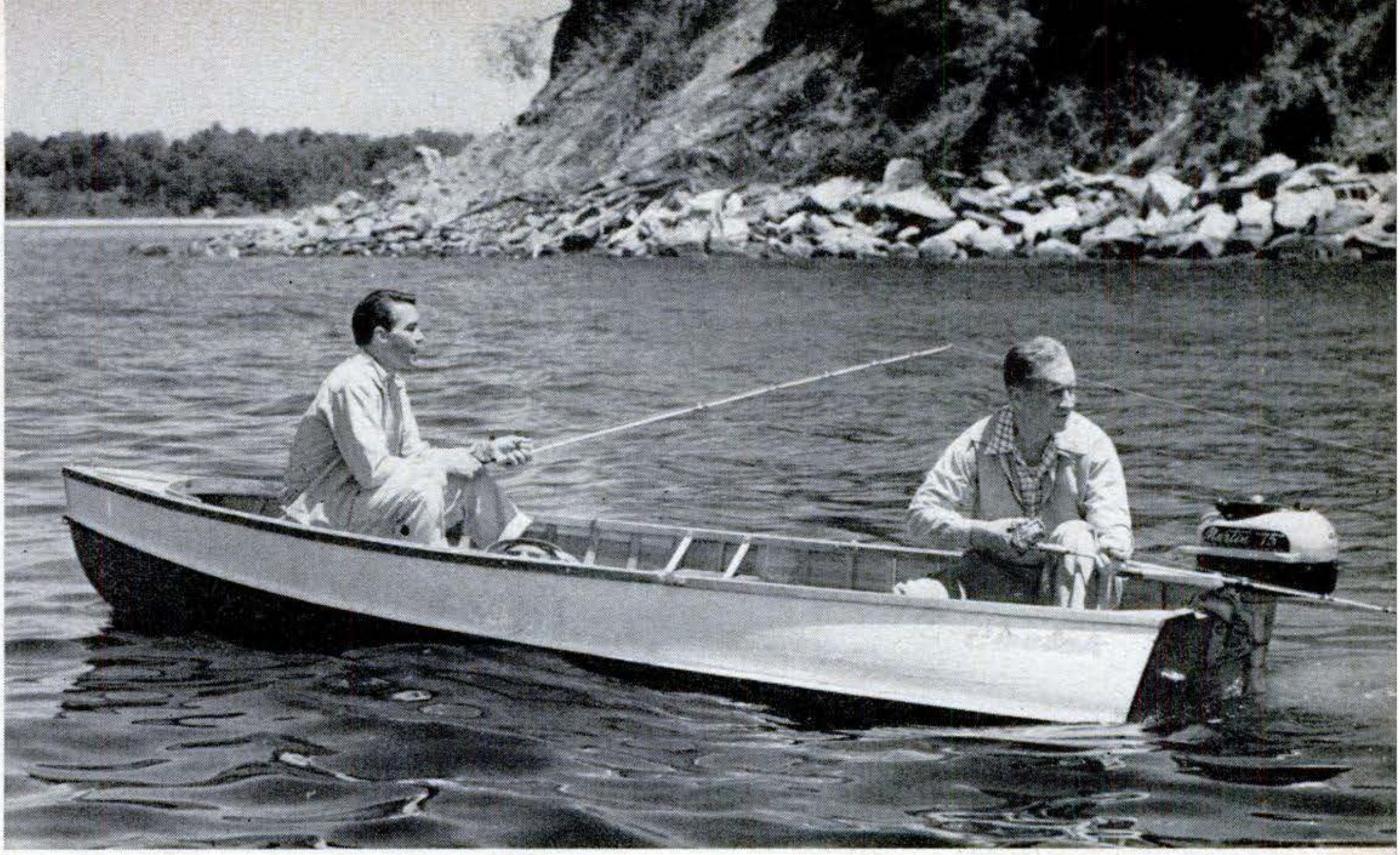

FISHING is main interest of more than three-fourths of outboard buyers, a survey shows. But half of the fishermen intend to use their boats for cruising, too. Motor above is Martin 75, a 7½-hp. job that weighs 44 pounds—typical of light weight of today's outboards.

Come on a cruise in the New Outboards

New features have turned the old put-put into a seagoing power plant that handles with the same ease as your automobile.

By Hartley E. Howe

"YOU don't have to tell *me* anything about outboards," I said. "Don't you know I used to have the snappiest boat on the river? You might as well tell Calvin Coolidge how to save money . . ."

"Speaking of Coolidge," said Joe, "just when did these nautical exploits of yours take place?" Joe eats, sleeps and lives outboards.

"I was in high school," I said. "Not so long ago. Before the war, of course."

"The Civil War, I suppose!" Joe replied sarcastically. "You wouldn't claim to be an auto expert because you had the first Model A in town, would you? Outboards have changed as much as automobiles. In fact, running an outboard now is almost as easy as driving a car—and more fun. Come on out on the river. That is, unless you're getting too old."

I couldn't let him get away with that one. On the way to the dock I got to thinking about my outboard. Maybe she wasn't *quite* the snappiest boat on the river. But she was a lot of fun. Getting under way was a real operation: the choke had to be fiddled with, the spark set just right. And then I'd pull . . . and pull . . . and pull . . . With luck, some time in the first 10 minutes she'd catch with a roar and lunge ahead while I grabbed for the tiller . . .

Sometimes we'd cruise as much as a quarter-hour before running into eelgrass. Before long it would be time to refill the tiny tank from one of the extra cans of gas we carried—if we'd remembered to fill the

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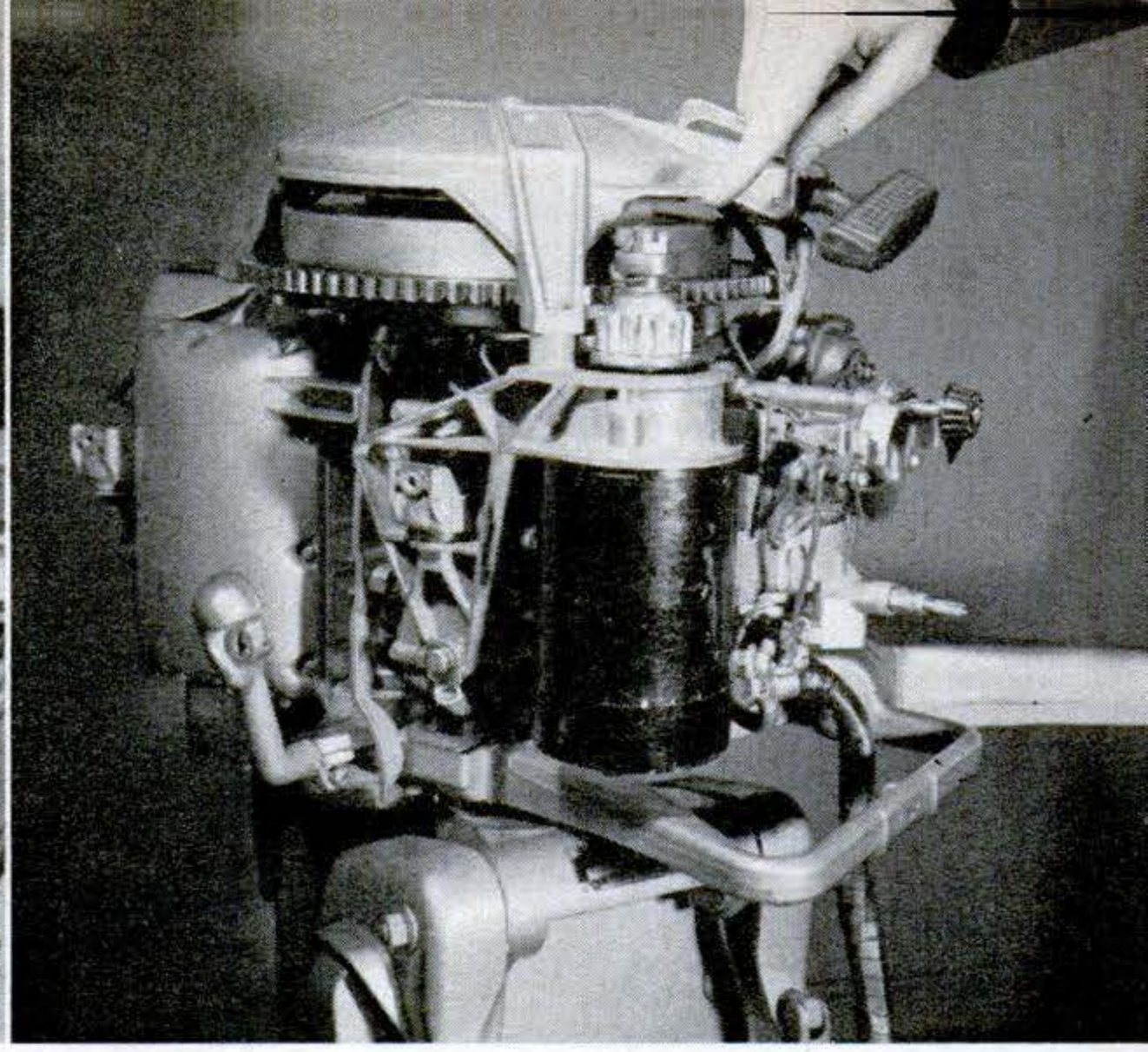
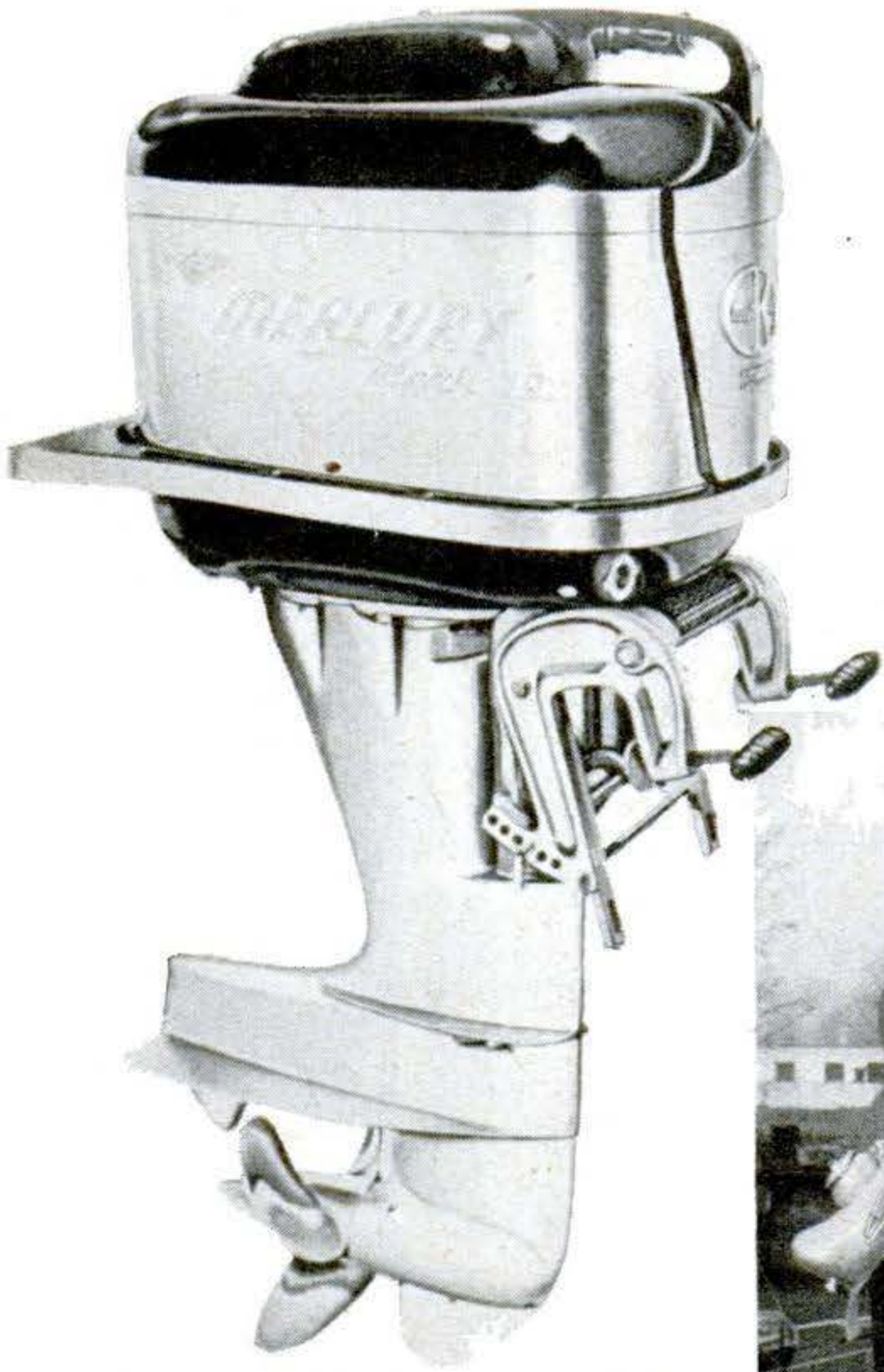


SELF-STARTER is newest outboard development. At left above, pressing button on dash spins engine. Shown in place on Evinrude at right above, battery-powered starter works like the one in your car, the gear on shaft of electric motor rising to engage the big gear on top of engine. Cord is kept for hand starting. Johnson features a similar self-starter.



BIGGEST U.S. OUTBOARD on regular market today is this brand-new four-cylinder Mercury Mark 50, designed for cabin cruisers, work boats, high-speed boating. Engine weighs 120 lb., is rated by manufacturer at over 40 hp. It is now the only U.S. four. (A 50-hp. U.S. four once built for racing is no longer made.)

cans. Once we rowed home, three hours against the tide . . .

"Hey, wake up!" said Joe. There was his new boat alongside the dock. She looked mighty trim—but I had my eyes open.

"What gives?" I said. "This isn't any outboard!" And I pointed to the stern, as bare as a girl on a garage calendar.

Joe grinned and opened a pair of cupboard doors fitted neatly under the broad stern deck. I peeked in. There, nested in a well, was an outboard motor.

"Hmph!" I said wittily and went forward. I had to admit it looked a good deal like the front seat of an auto, with an instrument panel complete with speedometer and tachometer, a couple of levers, and a shiny auto-type steering wheel. But I wasn't going to let on that I was impressed.

"A steering wheel,

AMONG LIGHTEST OUTBOARDS sold in U.S. today is 18-lb., ¾-hp. Anzani Minor (left), imported from England by Damac Corp., Roslyn, L.I., N.Y. British outboard makers, like British car makers, are sending U.S. market very lightweight jobs such as this one-cylinder model.

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eh?" I said. "I had one of those. The tiller lines took a beating, too. One time my girl was on the dock as I came in fast. The tiller lines broke and before I could get to the stern we'd bounced along the piling. Cost me a new girl and $50 for planking. By the way, where are the tiller lines on this job?"

"There aren't any, Pop," said Joe. "This boat steers hydraulically—just needs a couple of little rubber tubes to connect wheel and engine."

A Touch on the Button

As Joe slid in behind the wheel, I waited smugly. The darned fool had forgotten to go back to the stern to pull the starting line on the motor.

He leaned down and touched a button on the dash. There was a low roar.

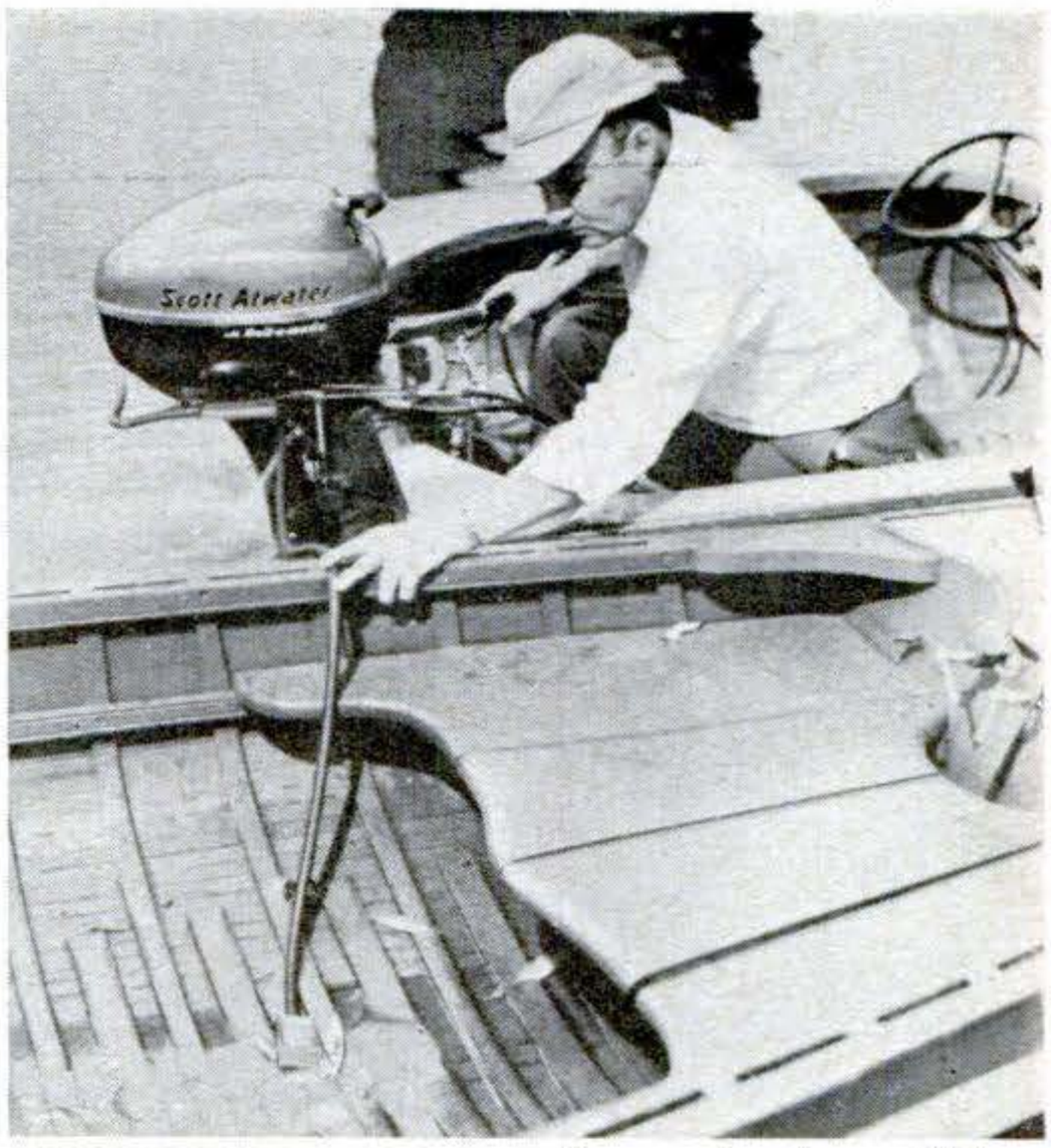
"What's that?" I asked.

Joe smiled patiently. "The motor. You know, the thing that makes the boat go."

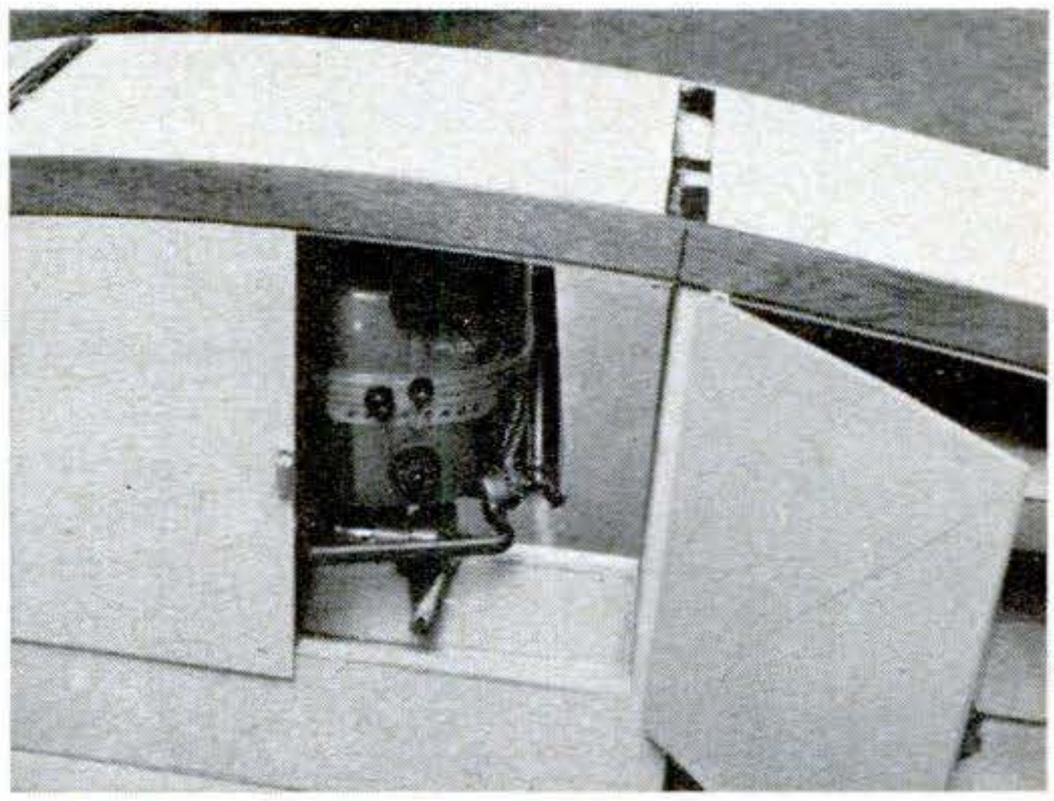
I shook my head. "Stop kidding. That's no outboard motor. A, you didn't go back there and yank the cord. B, the boat isn't moving. C—"

"Never mind C," he said. "You don't even know the ABC's of outboarding any more. This is a 1954 model, old-timer, and you no more pull a cord to start it than you crank your Buick. An electric motor does the same job in both places." A couple of the new '54 engines have starters powered by auto batteries, he explained. Big news.

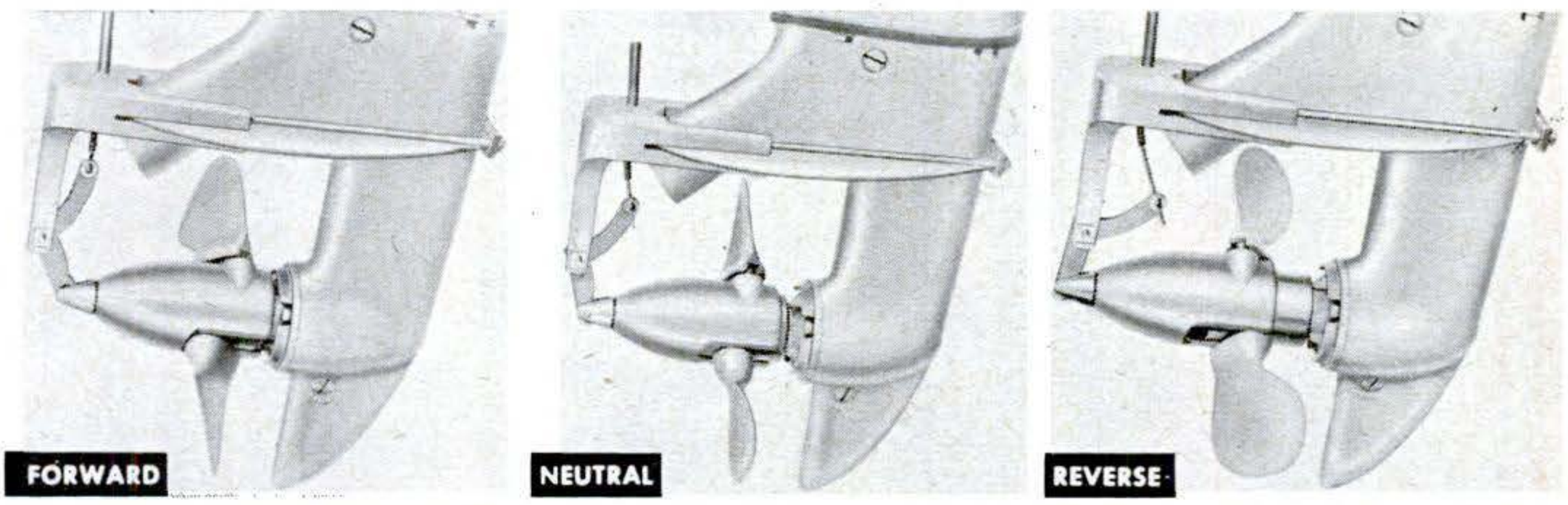
"And the boat doesn't leap ahead when the engine starts for the same reason your car doesn't. It's in neutral. Many outboards have forward, reverse and neutral gears now, and a good number have remote controls—worked by rotating cables. Of course



AUTOMATIC BOAT BAILER is standard on all but smallest '54 Scott-Atwaters. A positive-displacement vacuum pump, operated off drive shaft, can handle 150 gallons an hour.



SELF-BAILING MOTOR BOX is set in stern of new U-Mak-It kit-built cruiser. Bottom of box is watertight, draining overside. Rear deck section lifts out for access to motor.



VARIABLE-PITCH PROPELLER allows boat speed to be varied without changing engine speed. While engine is running, blades can be adjusted from within boat through complete range from full forward through neutral to full astern. Called Flex-Prop, device permits keeping engine at most efficient speed for cooling system and spark plugs.

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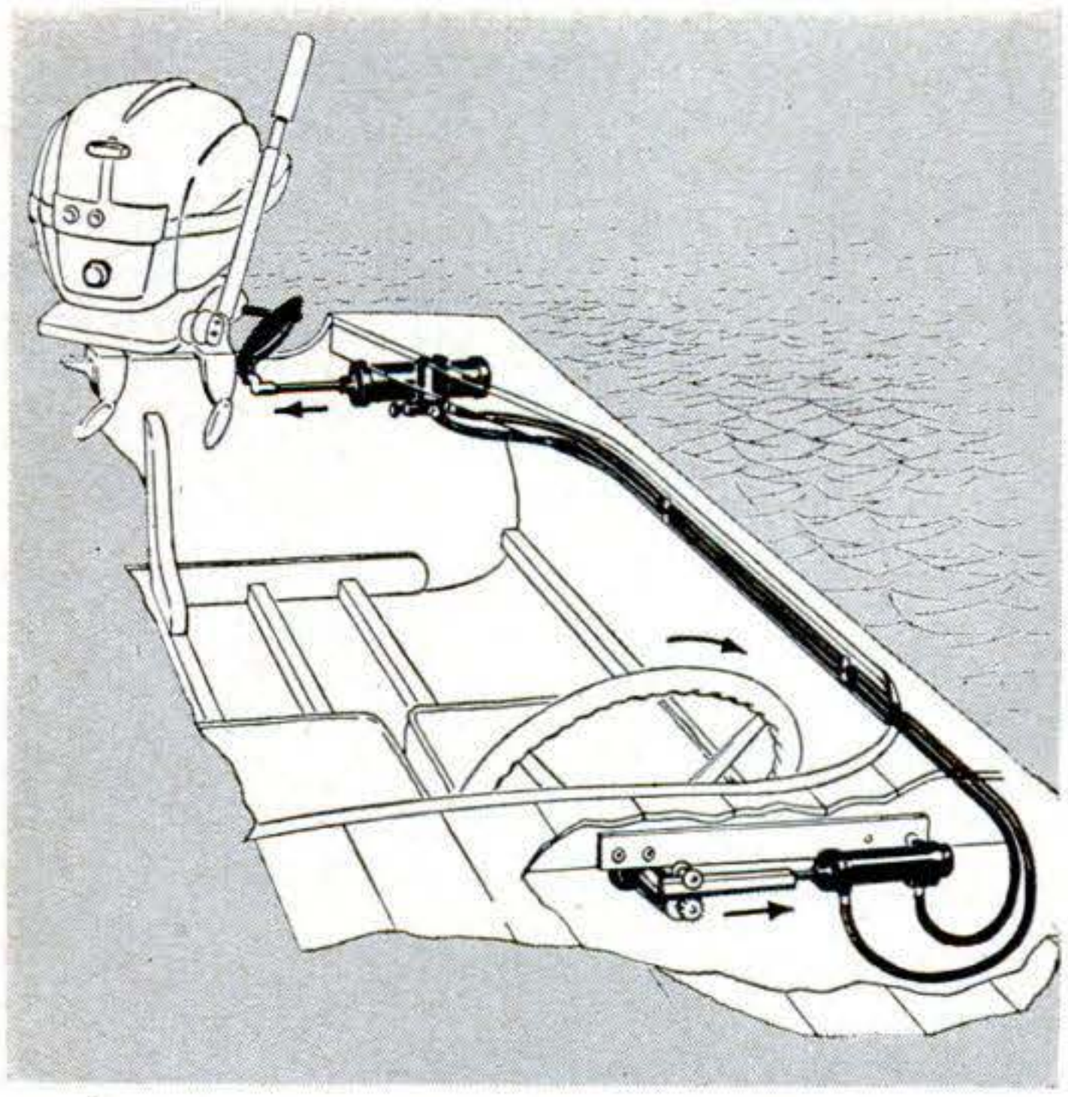


HYDRAULIC STEERING: Turning wheel moves piston in cylinder, forcing hydraulic fluid through tube. At engine end, fluid moves second piston, which swings engine, rudder.

you need this other lever—the remote control for the throttle—to be able to handle everything from the driver's seat."

I didn't have a ready answer to this. By now we were slipping smoothly downriver. It was Saturday and a lot of outboards were out. My friend waved at them as possessively as if he were old Ole Evinrude himself.

"See those? That's just the beginning. This past year they sold almost 40 percent more outboards than in '52—half of them first-time owners. That makes close to four million in operation."

"What do people use them for—racing?"

"No, fishing and cruising mostly. That's why manufacturers are emphasizing convenience and easy handling rather than high speed. Of course it helps that today's outboard keeps going no matter what. Why, not so long ago outboards ran the open ocean between Nassau and Miami."

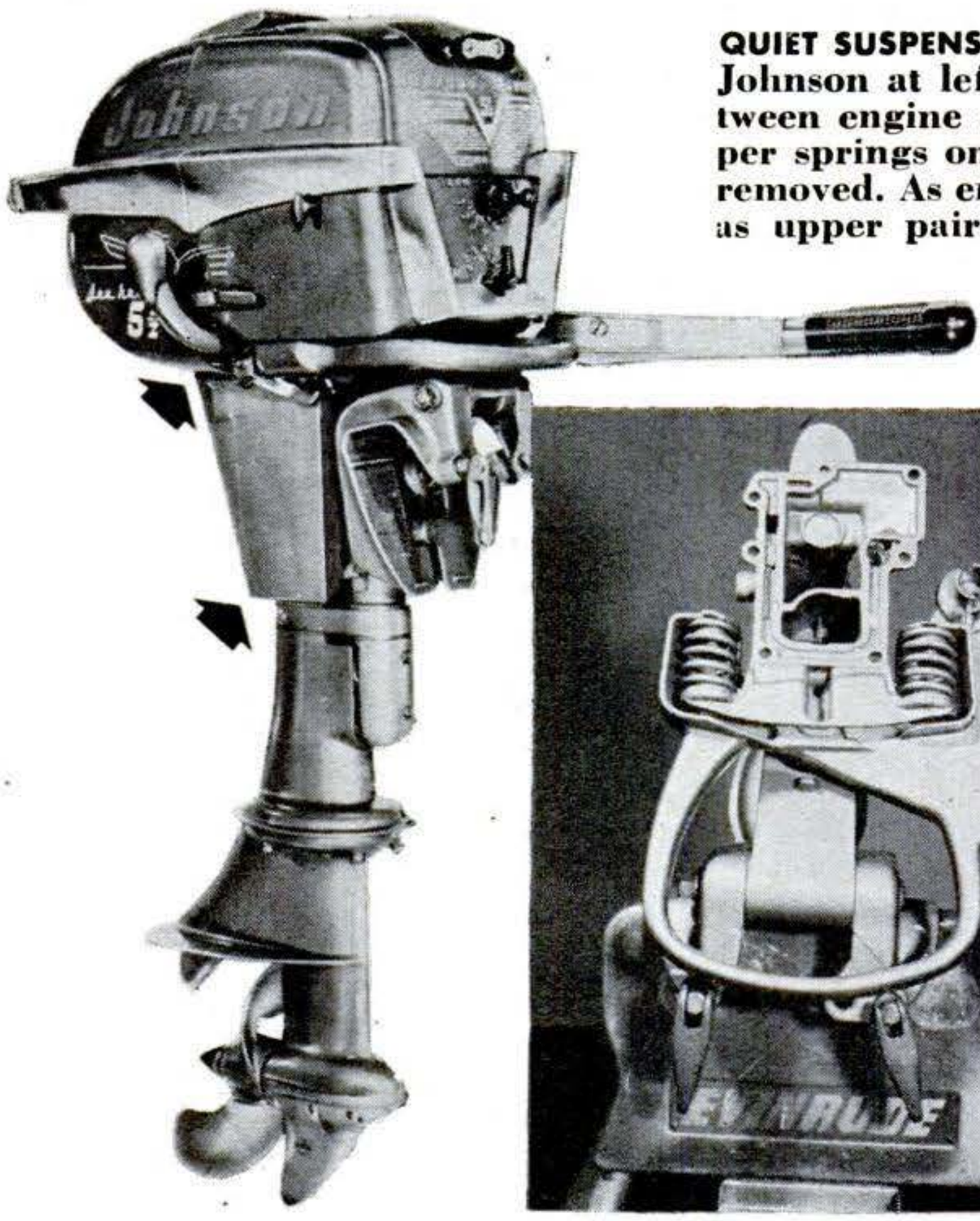
Pressure Keeps the Gas Moving

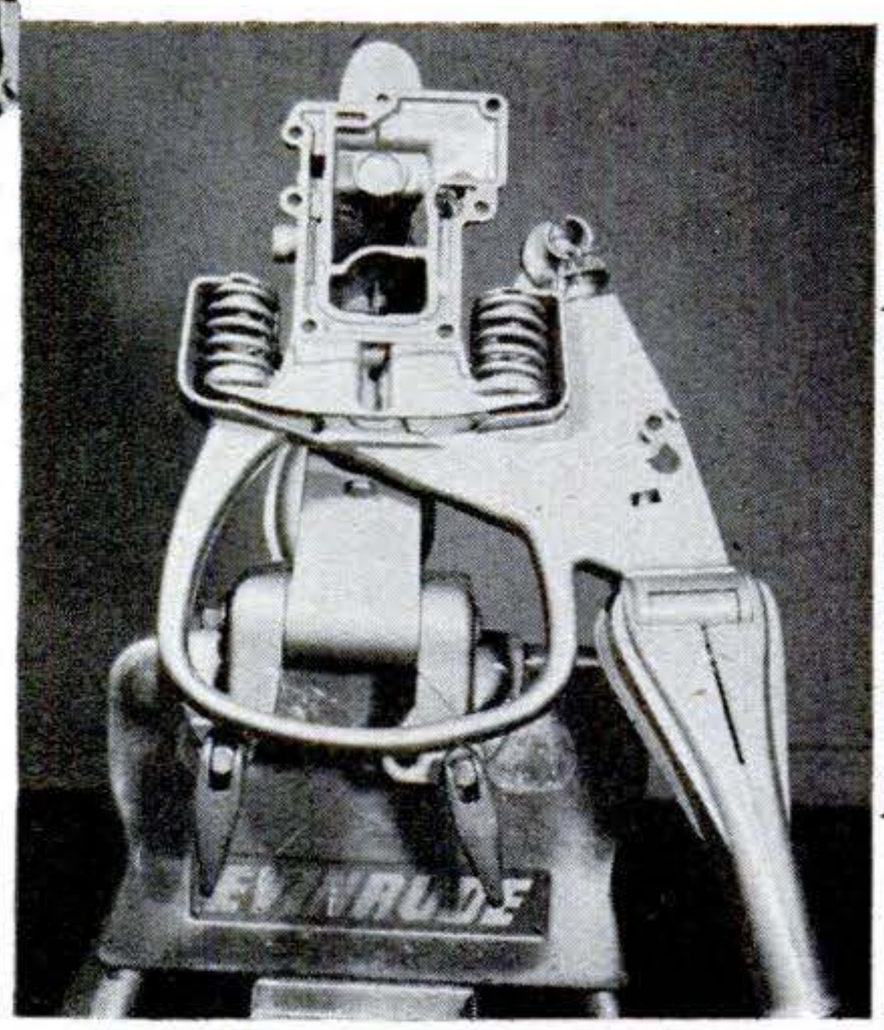
While Joe was talking, I looked over his boat. I found a big red can, stowed under the stern deck.

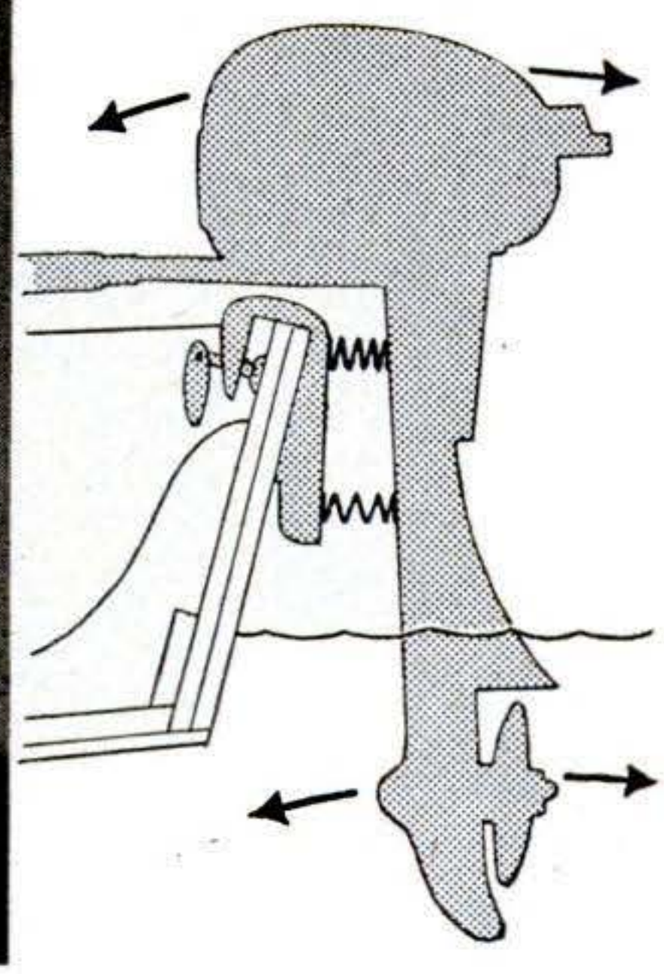
"They use big cans now, eh?" I asked. "That's a pretty hefty load to hike up on top of the engine while you pour it in."

"Hike up nothing," Joe said. "That can is feeding gas right into the engine tank. See that little pump handle on top? A few strokes build up pressure to start the gas moving; then pressure is fed back into the can from the crankcase to keep it flowing. With a couple of cans we can run all day. Some of the new motors come with fuel pumps for use with built-in gas tanks."

QUIET SUSPENSION is big '54 feature. Arrows on 5½-hp. Johnson at left show springs mounted horizontally between engine and its mount. Center picture shows upper springs on mount with engine—an Evinrude 7½—removed. As engine vibrates, lower springs are extended as upper pair are compressed; then process reverses.







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By this time we were well downriver. Ahead of us a clammer, put-putting along in an old skiff with a light outboard, turned in toward the flats.

"He's heading for trouble," I said. "That's full of eelgrass in there."

"Wrong again," said Joe. "Weeds may have been bad news in your day, but that guy's light twin is fitted with a skeg—a big fin—that keeps eelgrass away from the prop. And of course with any gearshift outboard, it's easy to throw the prop into reverse and unwind the whole mess in a second."

As we headed back, we met an open fisherman coming down. As the trim craft came abreast, there was a sharp bump from under her stern, her outboard bobbled and began to race, and the boat lost way. Apparently her prop had smashed into something—probably a half-sunken log.

I was ready to pass a line, when suddenly the racing engine returned to normal and the fisherman picked up speed again. "What happened?" I asked. "I thought that fellow had snapped a shear pin sure."

"Behind the times again," said Joe with a grin. "That fellow's engine has a disk drive with an automatic disconnect on the shaft. If the prop hits something, it's automatically separated from the shaft so the blades stop turning. When the prop is free, it hooks up again all by itself."

How to Hush an Engine

When we were tying up at the dock a trim runabout came zipping up the river. I could scarcely hear her. "What's that?" I asked Joe. "A galloping ghost?"

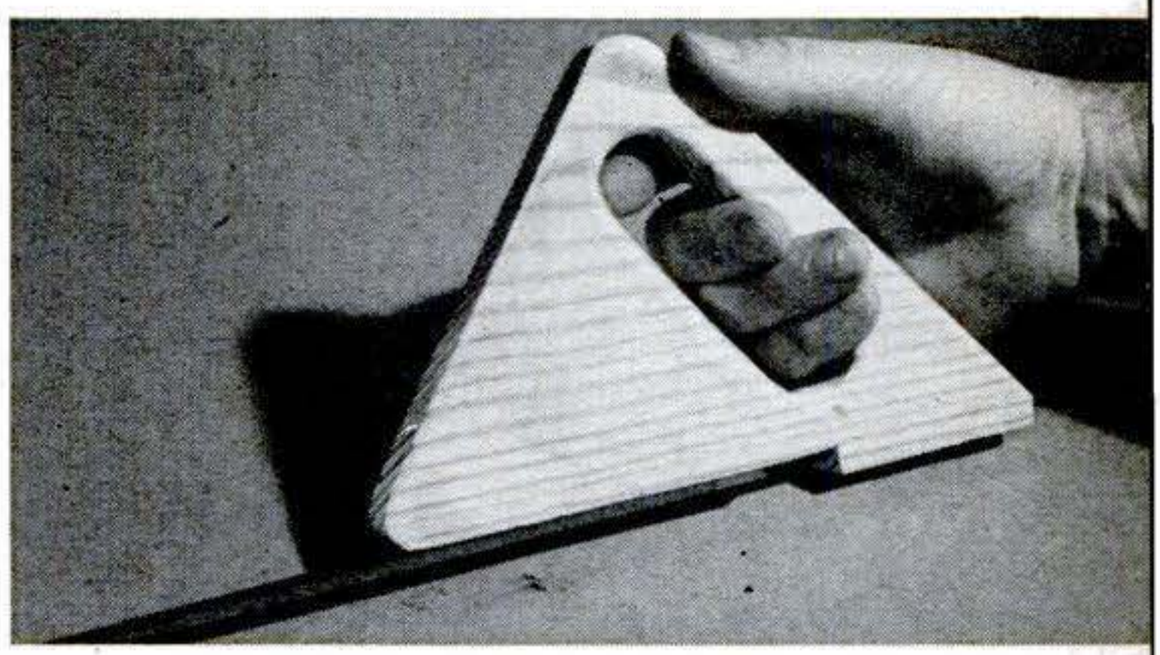
"Along with the self-starter, that's the big news in outboarding—silent engines," Joe replied. "Designers have found that most of the noise from an outboard comes from the boat, not the motor. The hull acts like a sound box to build up the noise, just as the belly of a violin builds up the sound from the strings. So a couple of manufacturers have hung their engines on two sets of springs that damp the vibration before it reaches the hull. I went out with one of the new jobs the other day and you could talk in normal tones right ahead of the engine.

"I tell you," he went on, "the outboard is getting all the advantages of the automobile. Why, now you can even get a directory of the good outboard waters in each state, just like an AAA guide. Wait and see—this is only the beginning!"

And he may be right at that. END

Doorstops Protect Boat

A ROW of inexpensive rubber doorstops screwed to the gunwale of a small boat will protect it from damage in docking and wear much longer than ordinary rope fenders that fray quickly. The stops are spaced several inches apart and need only occasional tightening to keep them serviceable.—*Larry Gottlieb, NYC.*

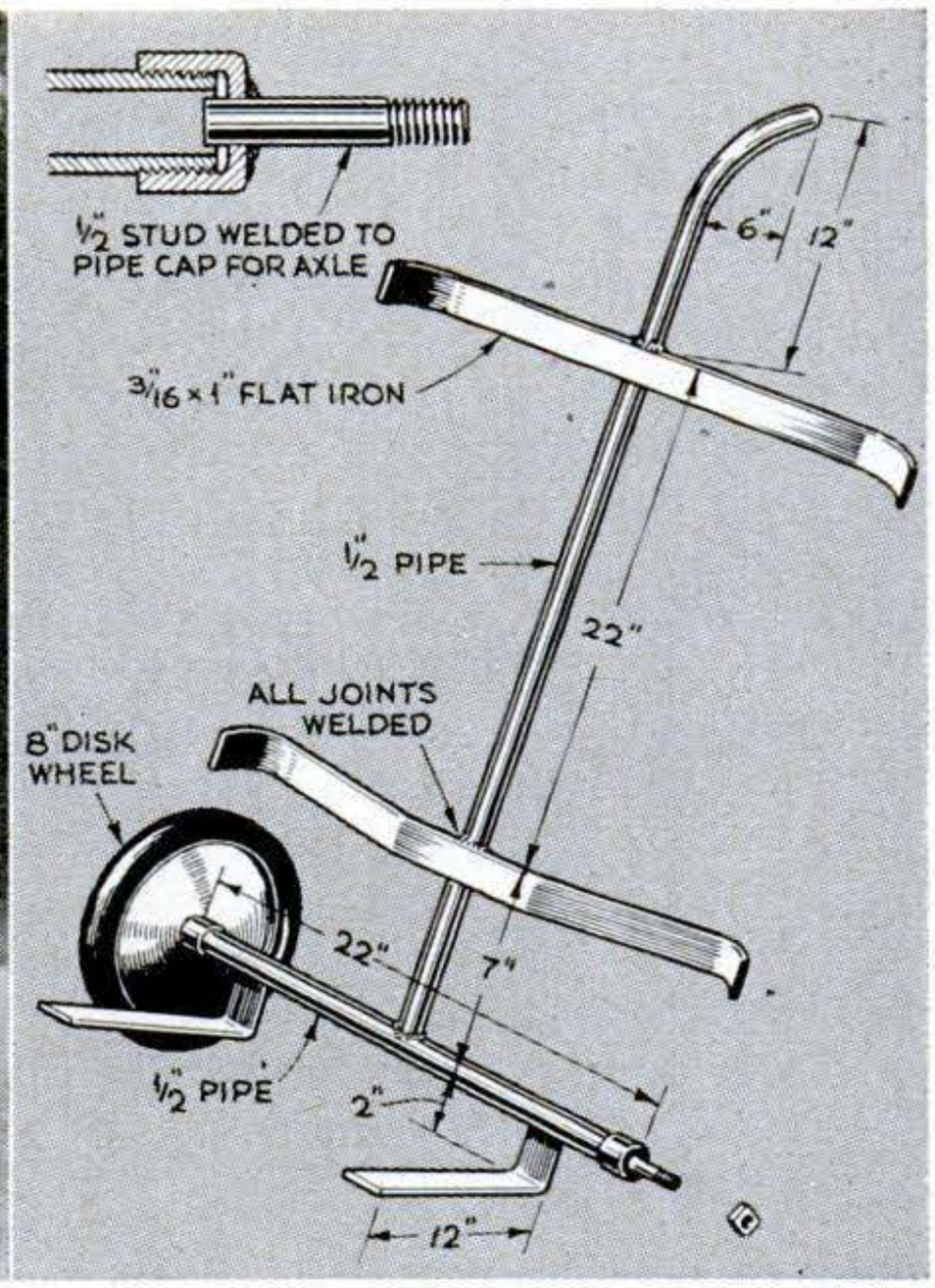


Handle Makes Filing Easier

THIS saw-type handle for a file is comfortable to use and lets you put pressure along the top of the file with one hand. Cut a triangle from 1″ stock, notch out the bottom to take the file, and drill a hole into the projecting ledge to hold the file tang. For finger slot, drill two 1″ holes about 3″ apart. Saw out the waste between.—*Ken Murray, Colon, Mich.*

Paintbrush Made from Rope

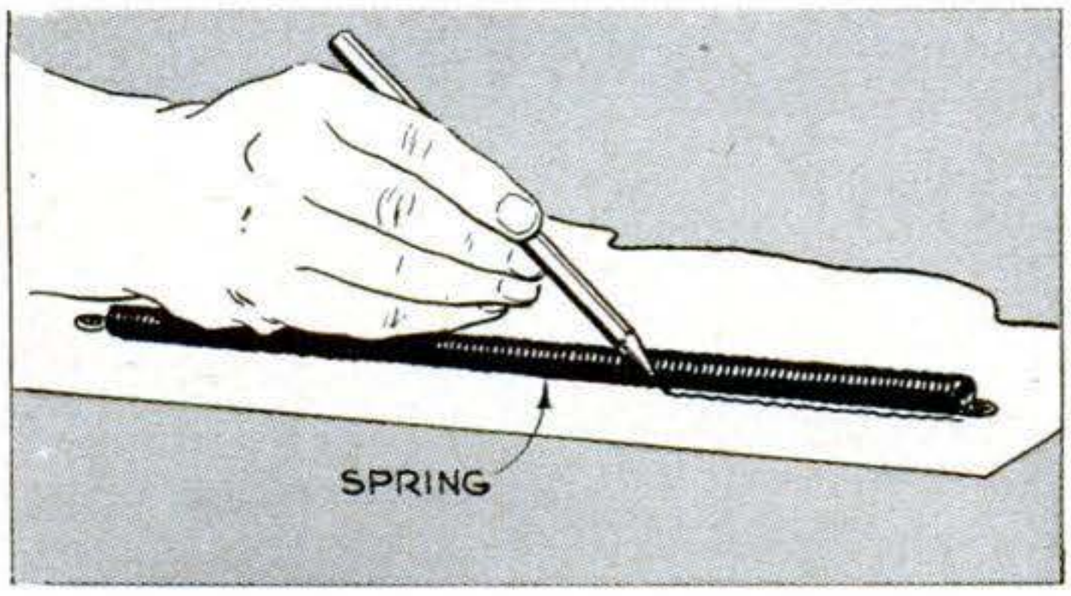
YOU don't have to wear out a good paintbrush on rough jobs like stenciling or spreading gasket or roof-patching cement. A piece of heavy rope, unraveled at one end and taped, makes a brush you won't have to clean. Snip off the used end and you're ready for the next job.—*Pvt. P. E. McCafferty, Fort Bliss, Tex.*



Welded Utility Truck Can Lighten Your Garden Chores

EMPTYING the incinerator or hauling bales of peat moss or fertilizer around the home grounds doesn't have to break your back. This utility truck, made from pipe and strap iron, can shoulder the burden and reduce the drudgery of gardening.

Weld two pieces of pipe together to form a T, then bend the longer piece into a curved handle. Weld the strips of iron to the body and make the axles by welding two ½" studs or bolts into holes drilled in two pipe caps.—*Hi Sibley, Nuevo, Calif.*



Spring Guides Wavy Line

A WAVY line makes a nice border for a showcard or poster, but it's hard to draw evenly freehand. If you just run your pencil along the edge of a coil spring, as shown, it will make a fine series of scallops.—*Victor H. Lamoy, Upper Jay, N. Y.*

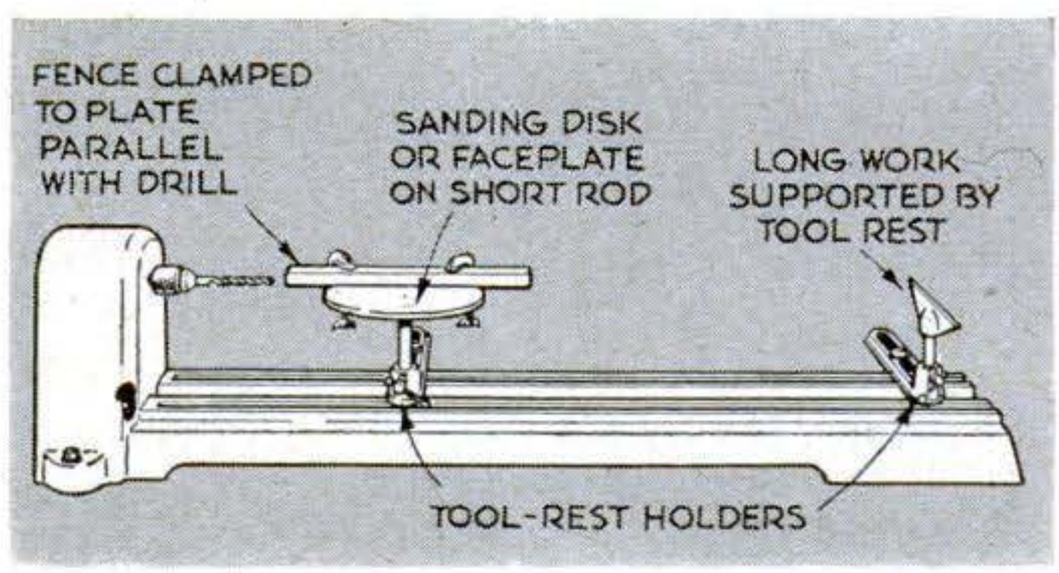
Keep Arresters Bare of Paint

IF THE lightning arrester on your TV set is on the outside of the house, be sure to mask it with heavy cloth before painting—particularly spray painting. If lead paint gets on it, your signal strength may drop.—*Marion L. Rhodes, Knightstown, Ind.*

Your Wood Lathe Can Bore, Too

WITH this rig, your wood lathe can be used as a horizontal boring machine for drilling odd-shaped parts or long mating pieces to be doweled.

Fit a short length of rod in the hub of a sanding disk and clamp it in the lathe tool-rest holder to serve as a boring table. Clamp a wood fence to the table to guide the work into the drill, which is held in the headstock chuck. Adjust table height and fence to line up the work with the drill. This setup can easily handle repeat operations or production drilling. Clamp the tool rest at the tail end of the lathe to support long work.



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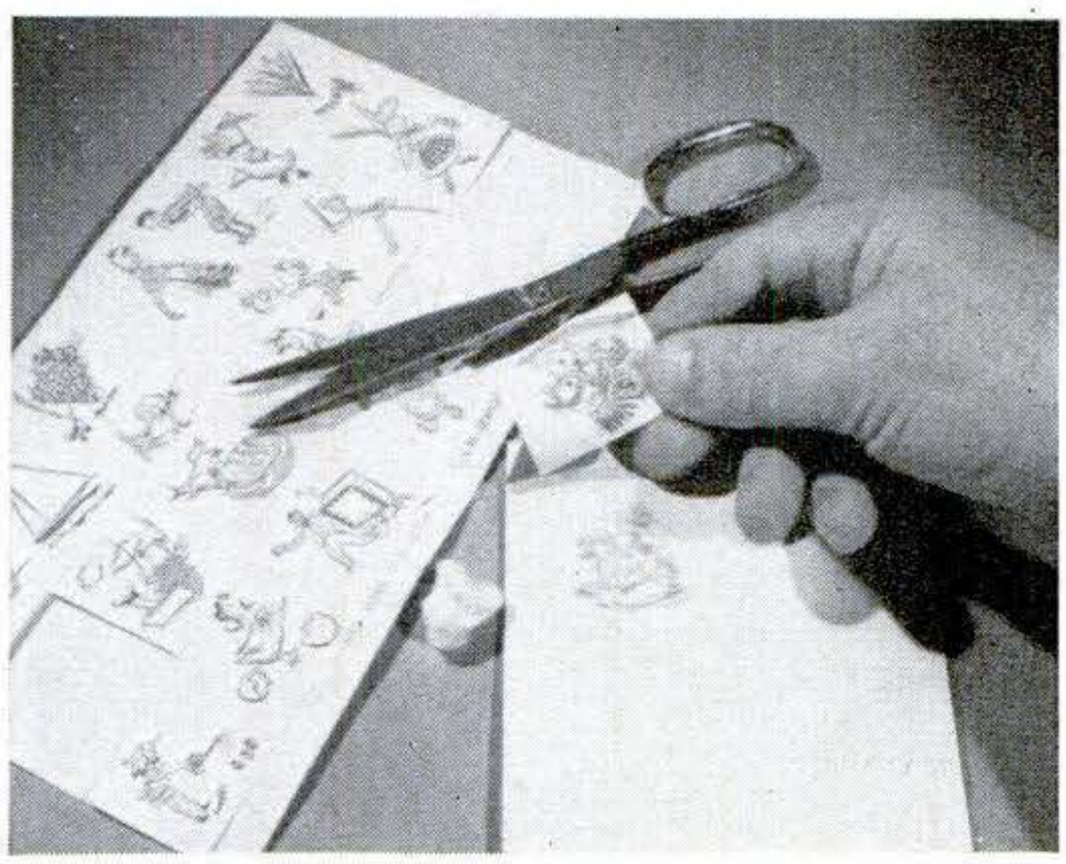
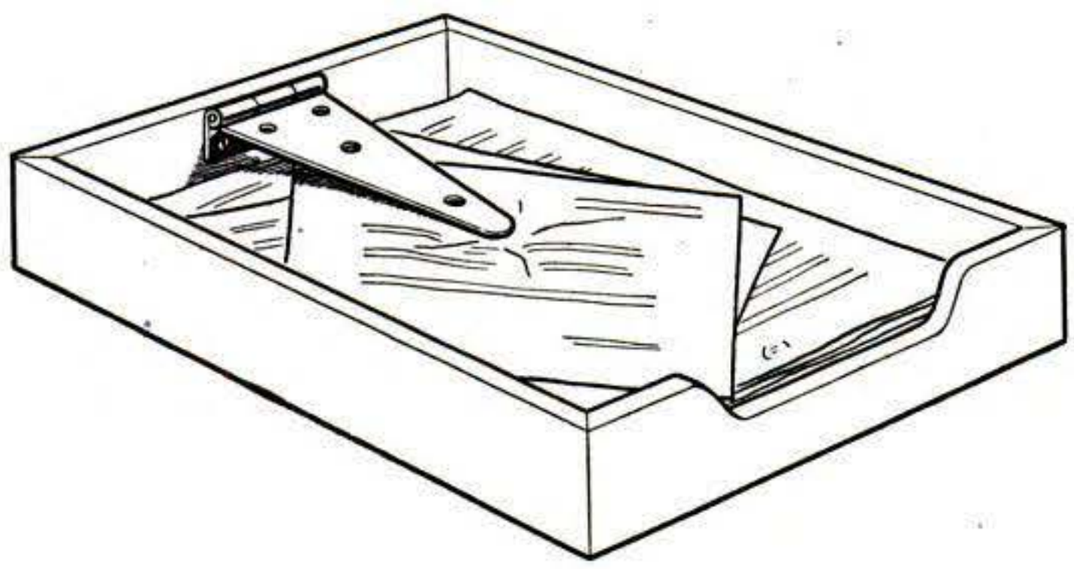


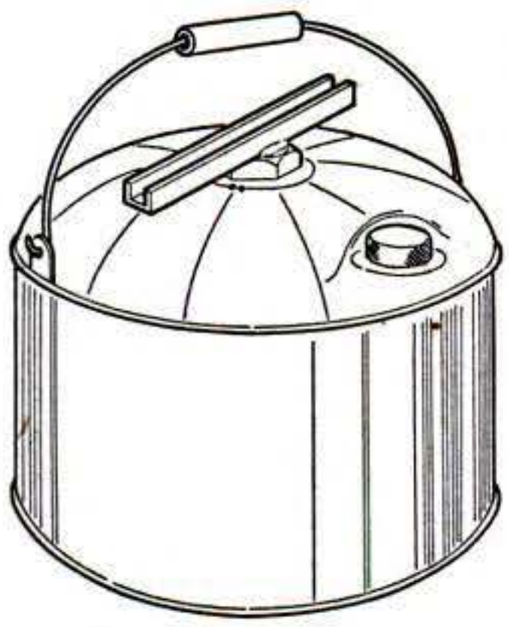
Easter-Egg Pix Decorate Paper

You can make the kids their own fancy stationery at low cost with the red and blue transfers that come with a package of Easter-egg dyes. To print a design, just place it on the note paper face down and moisten the back lightly with a bit of damp cotton or a piece of cloth.—*Ken Murray, Colon, Mich.*



Hinge Weights Paper in Tray

A HINGE, screwed to one end of a wooden file tray, will keep your papers from blowing away, yet allow you to slip them out easily. A strap hinge can be used if you hacksaw off part of one strap.—*Lewis Booker, Louisville, Ky.*



Channel Makes Filler-Cap Grip

IF THE gas can you use with your outboard has a filler cap that sticks tight, try soldering a 4″ piece of brass channel on the cap for a handgrip. And if the cap really freezes, you can lay a hefty screwdriver in the channel for more leverage.—*R. C. Roetger, Warrington, Fla.*

No Matter How You Slice It . . .

DURING last-minute party preparations my wife set me to slicing thin slices from a long skinny loaf of Vienna bread. All the knives were dull, so the first few pieces were badly mangled. But I slipped downstairs to my shop and crosscut the loaf into thin slices on the circular saw. She still doesn't know my secret.—*Leo R. Daugherty, Fort Wayne, Ind.*

Holes Let Paint Return to Can

THE groove that runs around the inner rim of a paint can wastes a lot of paint. I've found that punching or drilling several small holes in the groove lets the paint that collects there drain back into the can. Not only do the holes save paint and keep the outside of the can clean, but they allow you to replace the cover tightly when you're through.—*Howard E. Moody, Upper Jay, N.Y.*

3-D Glasses Dim Pilot Lights

ILLUMINATED dials or other indicators that glare with eye-straining brilliance can be dimmed by disks cut from the viewers for 3-D movies. Adjust them by rotating one over the other to pass the amount of light desired. Tape in place.—*William B. Woodington Jr., Philadelphia.*

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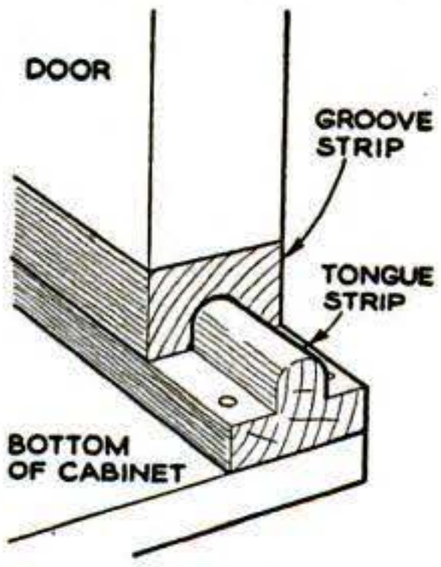
Rubber Keeps Bait Jar Closed

A SLIT strip of inner tube across the top of your live-bait jar will let your hand in but keep the liveliest frog or cricket from jumping out. Cut a circular piece, allowing about an inch of overhang all around the jar. Stretch it taut across the jar opening, and bind it with wire or string. Use a razor blade to slit the self-closing handhole. Punch or cut several openings in the rubber to let in air.—*Thomas P. Ramirez, Fond du Lac, Wis.*

Saw Doubles as Pruning Blade

IF YOU use a pruning saw only occasionally, you can make a satisfactory rig with a blade borrowed from an ordinary nest of saws. Choose one of the narrower blades and bolt it as shown to a flat pole of the desired length. Since the saw blade is unaltered, and can be quickly removed, it is always readily available for use with its regular handle.—*Robert Tyson, NYC.*

Flooring Strips Make Slides



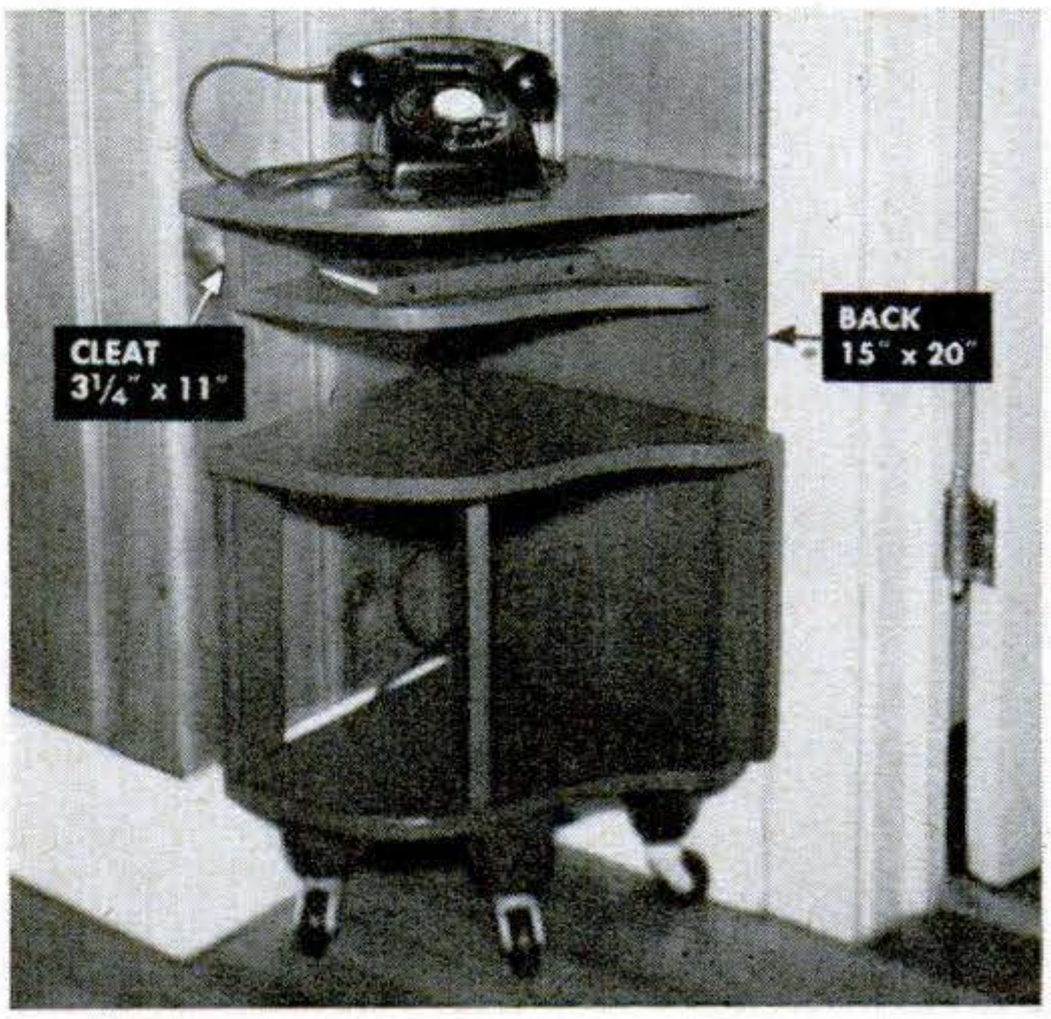
TONGUE-and-groove strips ripped off the edges of standard flooring provide ready-made slides and tracks for small cabinets. Nail the tongue strip to the bottom of the cabinet and the groove strip to the bottom of the door. Rub both strips with soap to make the door slide easily. The top of the door, which is held in position by two strips of wood, needs no track.—*Richard B. Spitler, Yellow Springs, Ohio.*

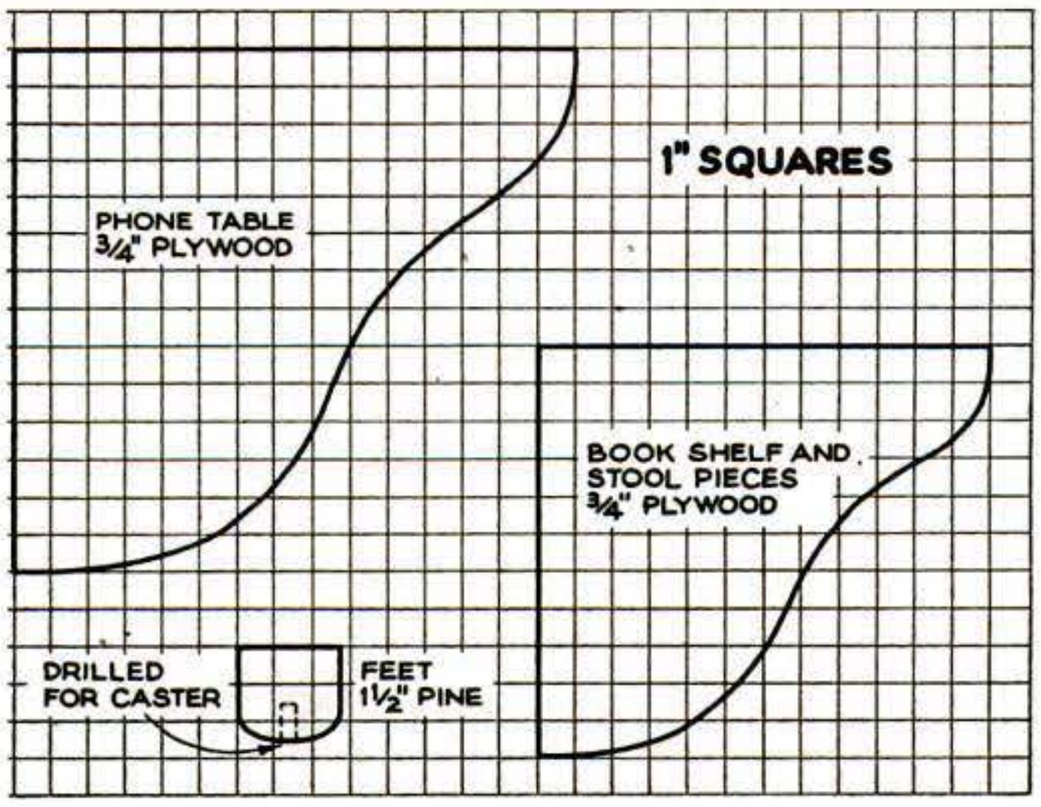
Conversation Piece for Phone Corner Has Rolling Seat

A TIGHT corner in a hallway is no place for a telephone, but if you must have it there, this compact table with matching stool will not interfere with traffic.

Cut all parts from ¾" plywood except the feet; these are made from 1½" pine and drilled for casters. Assemble the table and backboard before attaching it to the wall. Join the parts with glue and nails. Locate the wall studs, and drive screws through the backboard and shelf cleat to secure the table. Assemble the stool, also with glue and nails, and install the casters.

Sand and paint or varnish to harmonize with the surroundings.—*Mrs. Ruth M. Larson, Rochester, Minn.*





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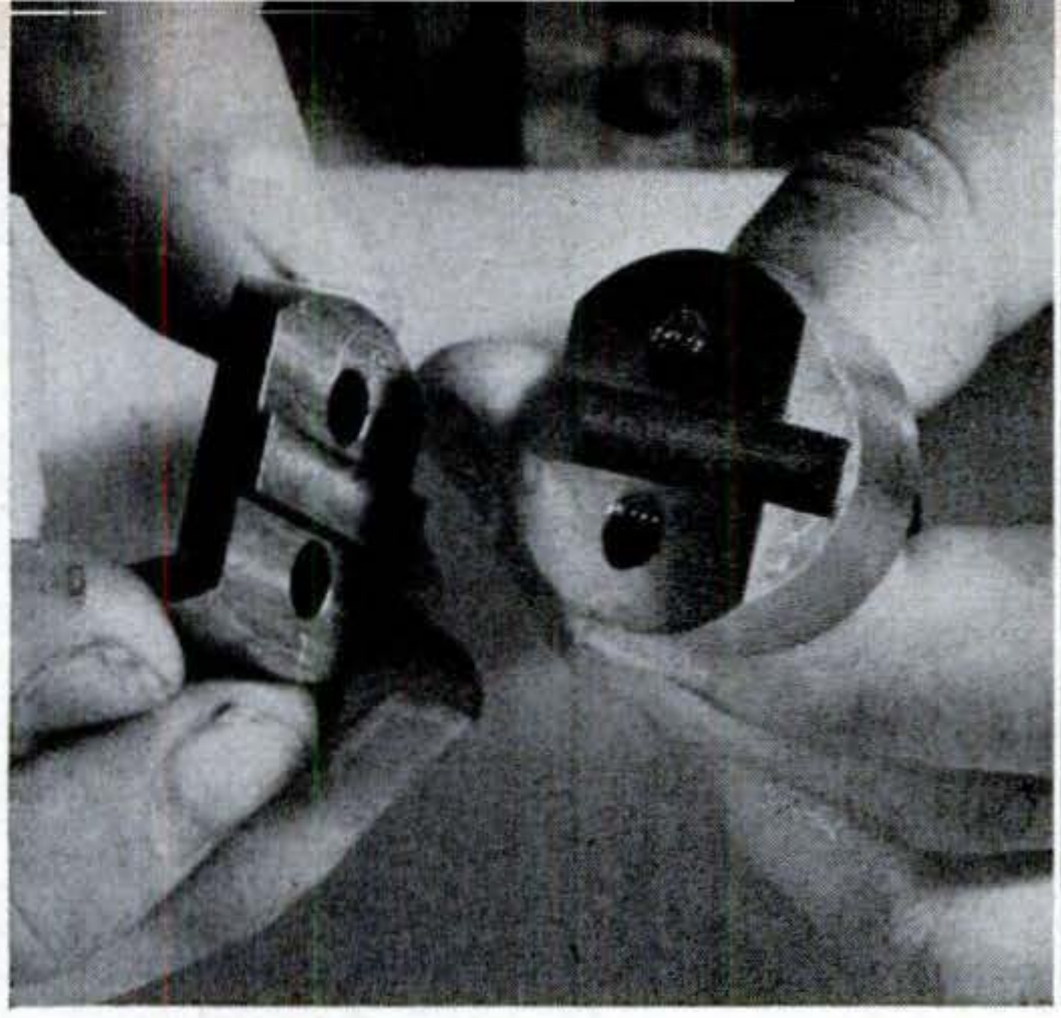
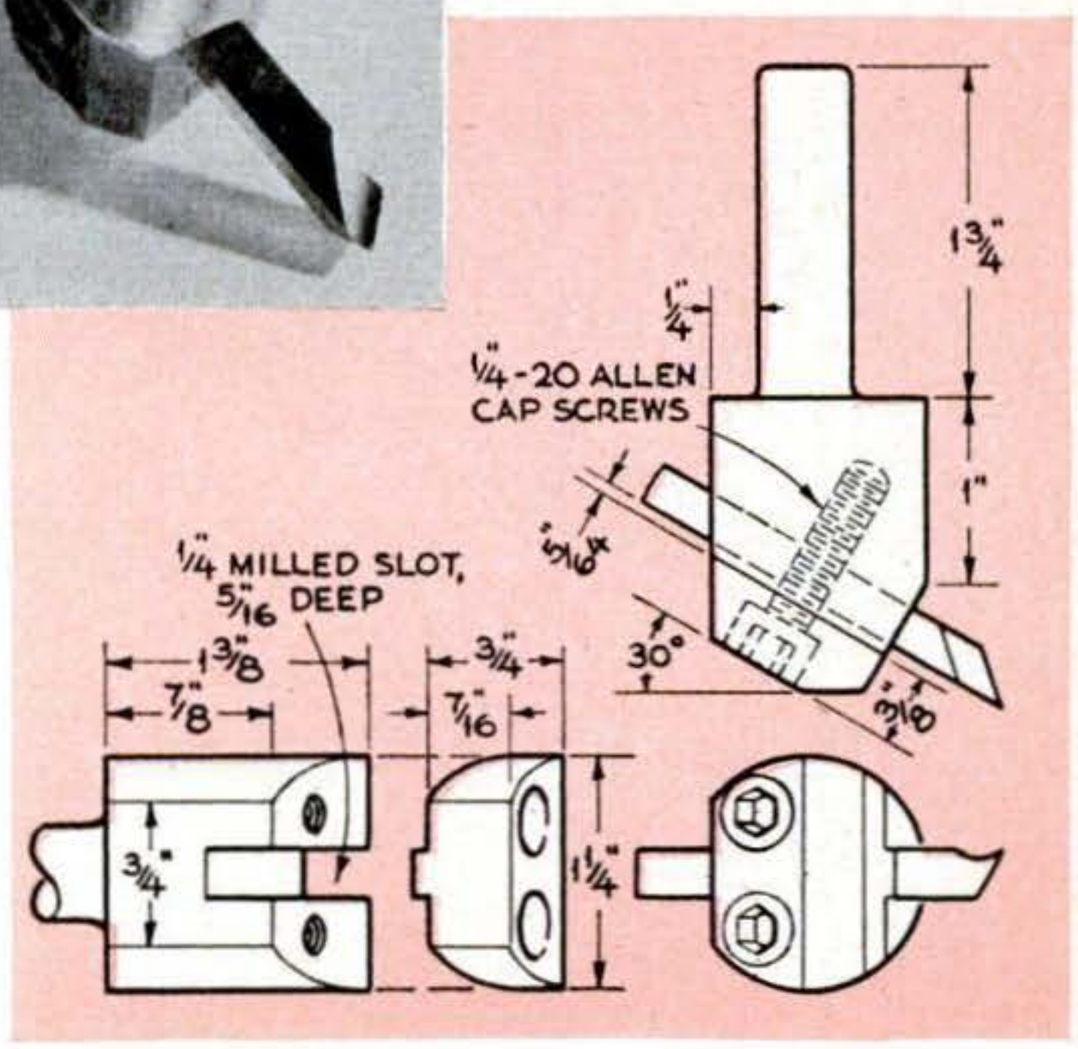


NEW Shop Ideas

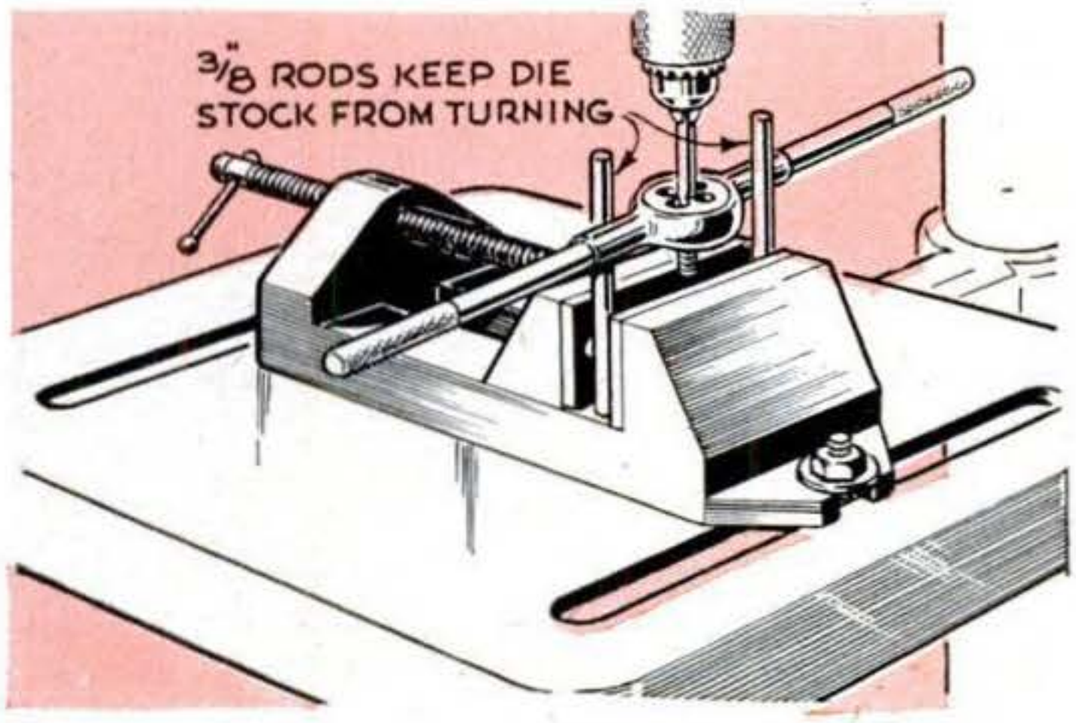


Fly Cutter Mills Smooth Surface. Because it throws the chips out, instead of carrying them in the teeth like a milling cutter, a fly cutter gives smoother finish when used for milling surfaces. This one grips a ¼" lathe bit in its grooved head. A matching cap, forced against the bit by two Allen screws, holds it in position, yet permits adjustment.

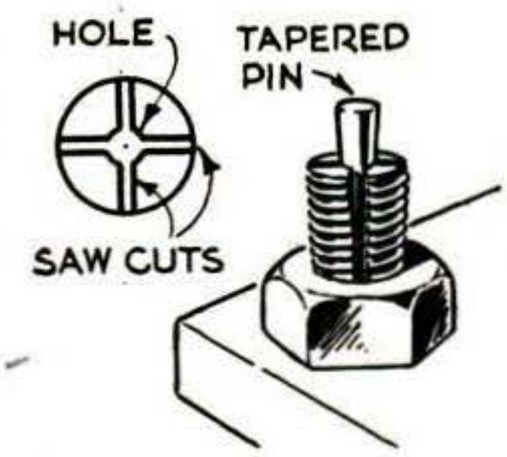
Turn the body in the lathe and mill a 30° bevel on the end. Mill a ¼"-square groove in the beveled face and drill and tap two holes for the setscrews. Shape the tongued cap from ½" flat stock to fit roughly over the head and attach it with the setscrews. Then chuck the assembly in the lathe to bring the cap to the body shape. *–Gus W. Hall, Brooklyn, N.Y.*

Rod Threaded in Drill Press. Faced with the problem of threading a number of rods, all smaller than ½" diameter, I rigged a threading setup in my drill press.

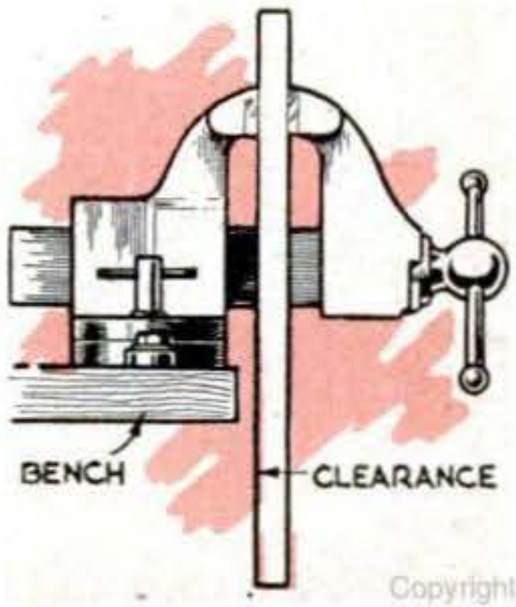
I clamped a vise to the drill-press table and locked two pieces of ⅜" rod in a vertical position between its jaws. The rods to be threaded were chucked in the drill press and fed at slowest spindle speed into a diestock set between the two vertical rods. The rods prevented the diestock from turning, yet allowed it to slide upwards as the die cut the threads.*–L. Hoyland, Stoke-On-Trent, England.*



Tapered Pin Locks Nut. To lock a nut that must be removed at times, drill a hole in the end of the bolt and hacksaw two slots part way down it. Then turn the nut down tight and drive a tapered pin into the hole to spread the slotted bolt end. Pull out the pin with a pair of pliers when you want to unscrew the nut.*–Federico Strasser, Santiago, Chile.*



Bench Vise Tip. Before bolting a vise to the workbench, check to be sure the face of the rear stationary jaw overhangs the edge of the bench, if only by a fraction of an inch. With the vise mounted this way, you'll have no trouble gripping long shafts or rods vertically between the jaws of the vise.*–Andrew Vena, Philadelphia.*



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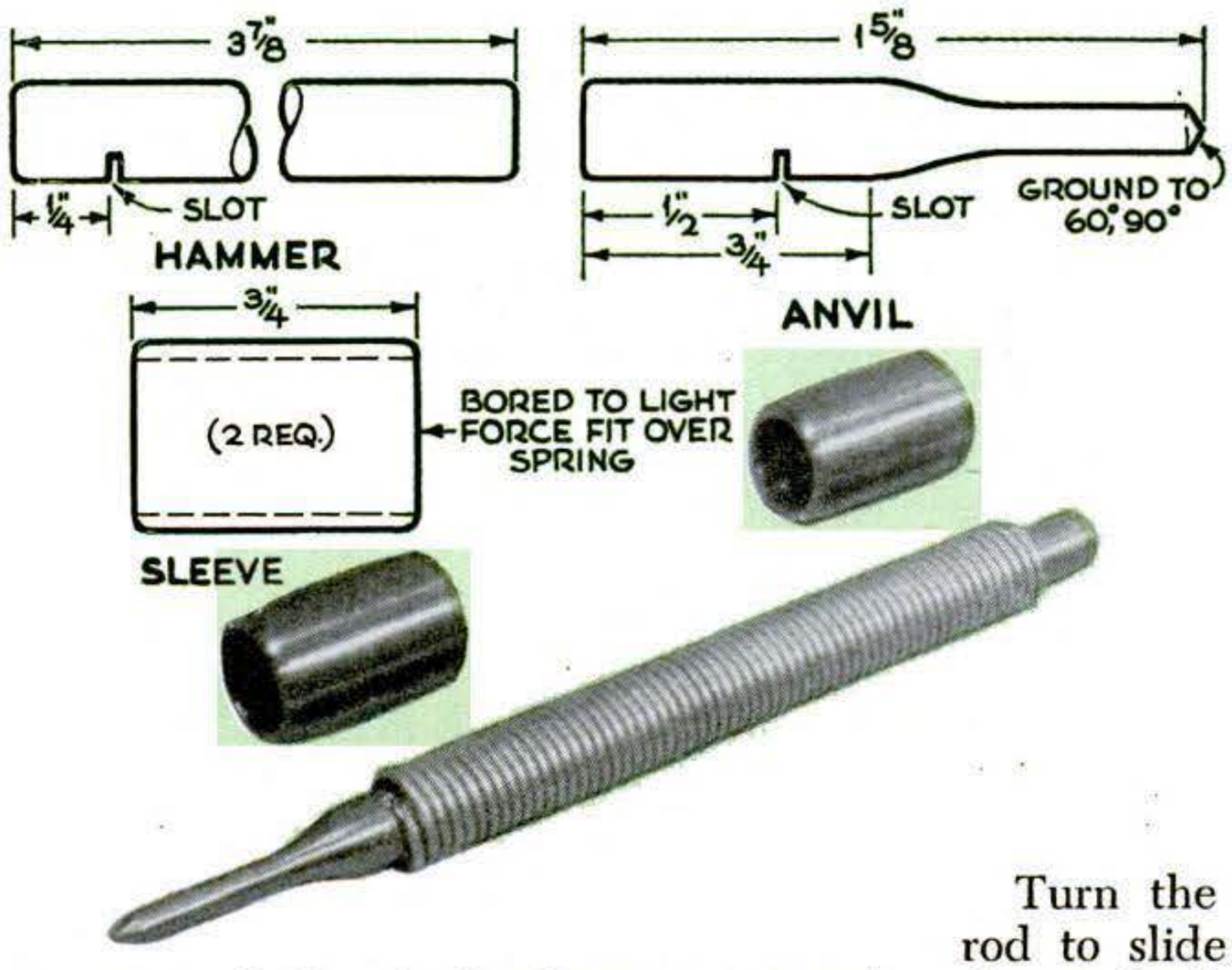
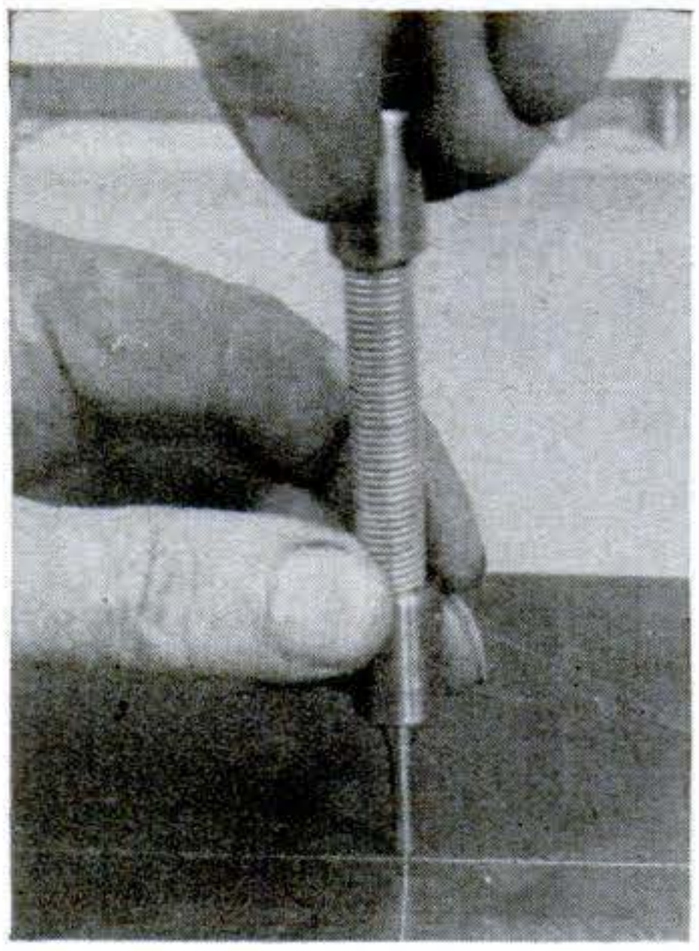
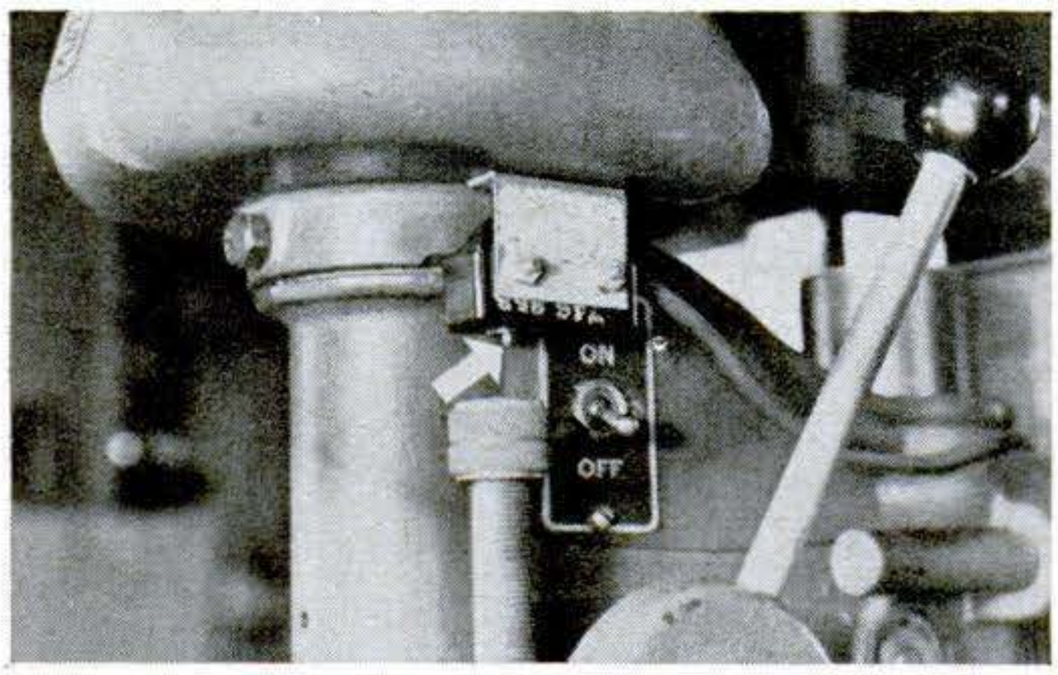




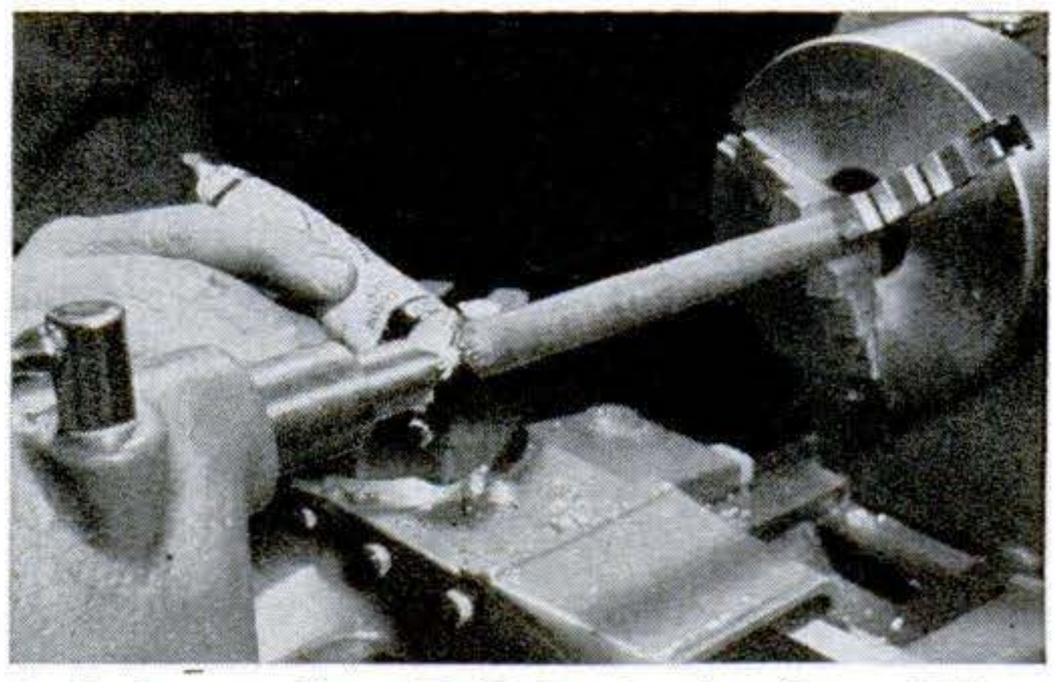
Spring Punch Needs No Hammer. Punch your center marks right on the nose with this spring punch that has its own hammer built right into it.

Use a ⅜" o.d. tension spring, about 4" long to serve as both power for the hammer and outer case of the punch. The spring should be just stiff enough to be easily pulled apart with the fingers, yet snap back sharply when released.

Turn the hammer and anvil from drill rod to slide easily inside the spring. Saw slots in both parts and drive the spring ends into them. Cap the top and bottom of the spring with two sleeves turned to a light force-fit over the spring diameter. Grind the point, after hardening, to 60° or 90°, as desired. In use, the point is held on the work while the top sleeve is pulled up and released. This rams the hammer sharply against the anvil, driving the point into the work.—*Will Thomas, Buffalo.*



Snap Switch Controls Drill Press. A drill press can be made to turn itself on and off automatically with a normally closed snap switch (arrow) installed above the depth gauge. Mount the switch on a bracket screwed to the belt guard and wire it in series with the regular toggle switch. When changing drills, flip toggle switch to OFF to prevent accidental starting, then flip it to ON for automatic operation. As the spindle is moved down to the work, the top end of the gauge releases the switch button, starting the motor. Raising the spindle shuts it off. Tape switch terminals to prevent accidental shorting by metal chips.—*Elbert Robberson, Port Washington, N.Y.*



Lubricant for Tailstock Center. White or red lead makes an excellent lubricant for work held between centers in the lathe. Unlike oil, it will not fly off the rotating work or squeeze out of the centerbore. Bought in tube form, it is easy to apply and will not harden, as it might in a can.—*Joseph Tracy, NYC.*

Hacksaw Tips. When cutting thin tubing, mount two blades in a hacksaw with the teeth pointing in opposite directions to minimize grabbing. When sawing overhead, use one blade with the teeth toward you.—*L. M. LaBar, West Pittston, Pa.*

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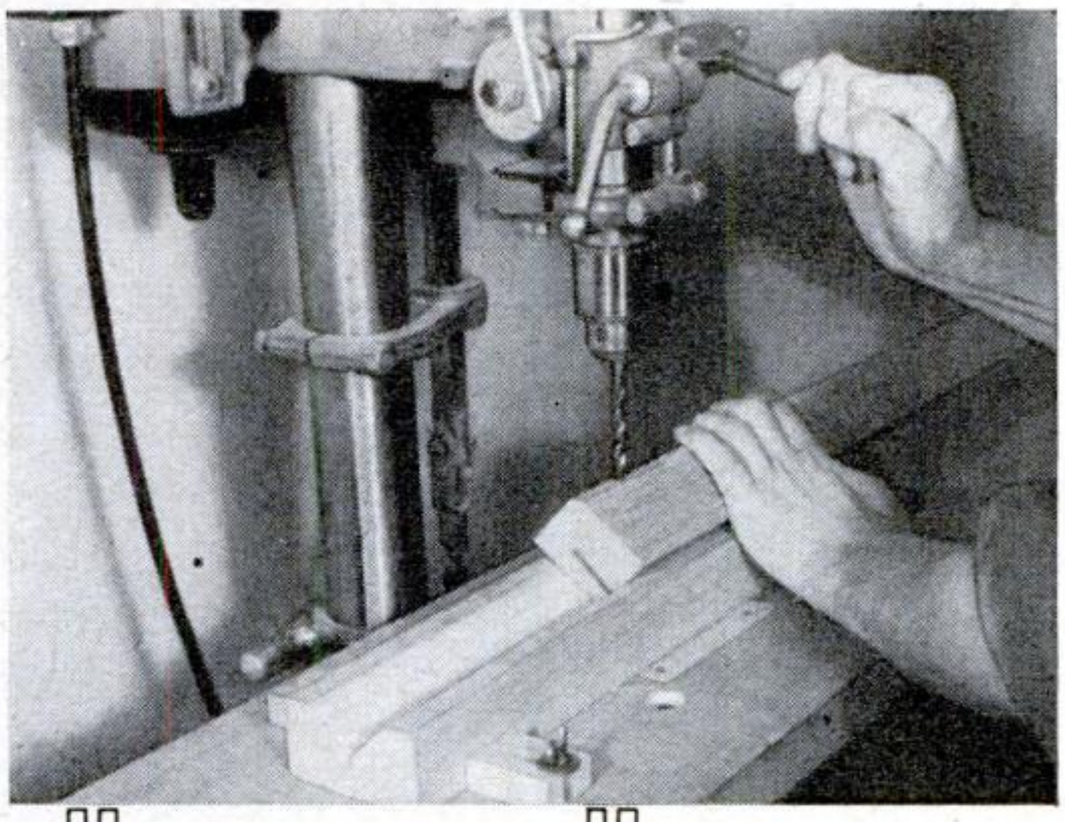
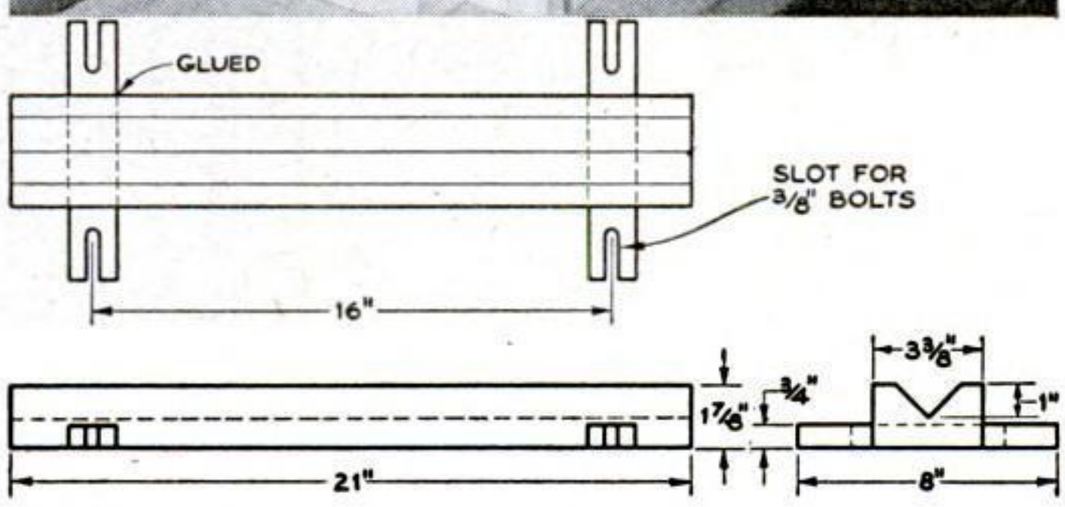




V-Block Jig Speeds Drilling

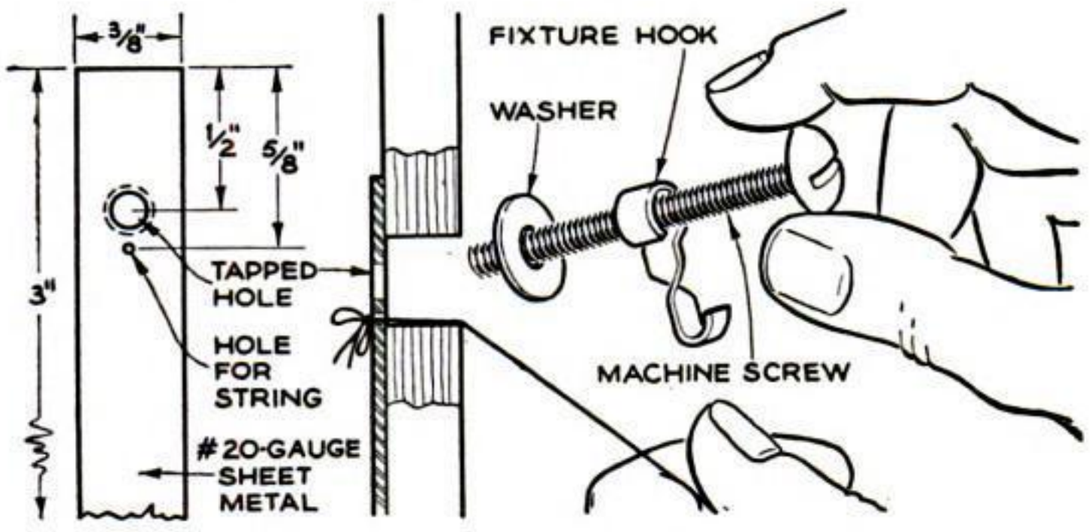
THIS jig centers all square or round work and aids in drilling holes through table legs, turnings or round stock.

Make the block by cutting a 1″-deep V with a table saw set at 45°. Then cut two 1½″-wide grooves across the bottom at each end for bolting strips. Slots cut in both ends of each strip permit you to shift the block until it is centered under the drill-press spindle. Use a finishing nail as a stop when drilling duplicate pieces.—*Gordon D. Carlson, Minneapolis.*

Metal Strip Subs for Toggle Nut

A METAL strip can be slipped behind a thin wall to make a bolt hold. Thread a hole in the strip to receive the bolt. Drill a hole in the wall just big enough for the strip to slip through. Knot a light string in the strip and push it through, lining up its hole behind the hole in the wall.

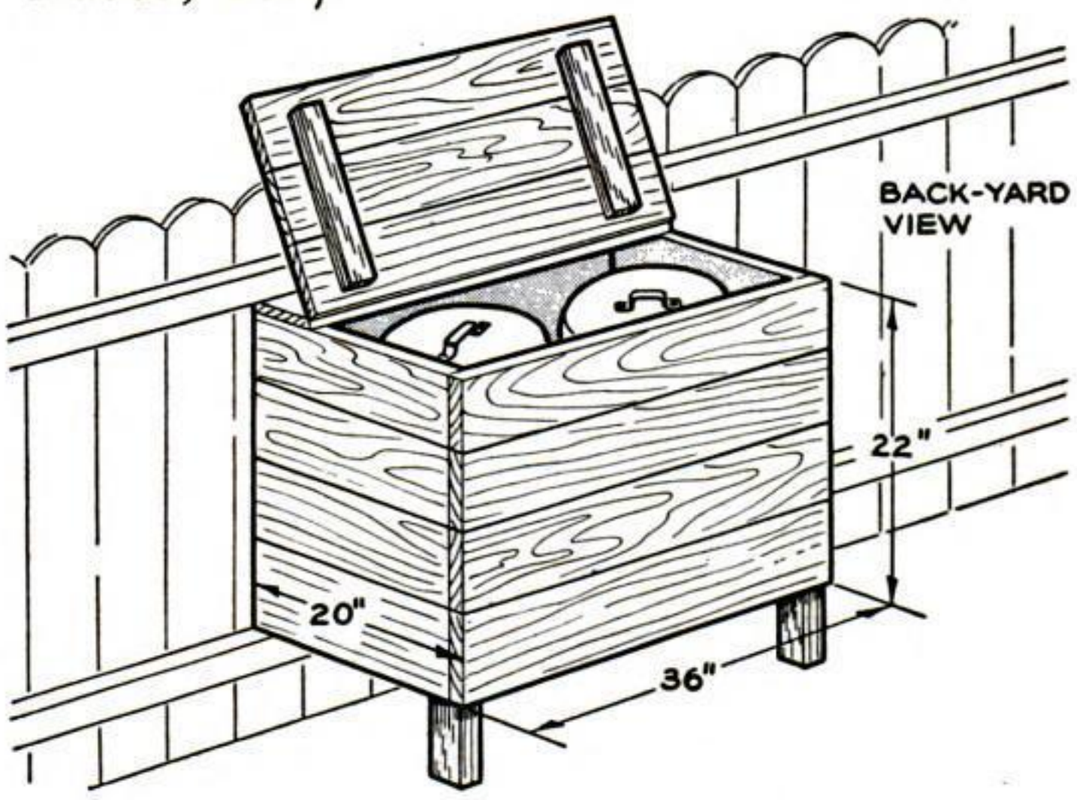
Thread the bolt into the strip and cut off the string. You can use a washer to cover the hole in the wall.—*John C. McDowell, Maple Shade, N. J.*



Trash-Can Bin Is Dogproof

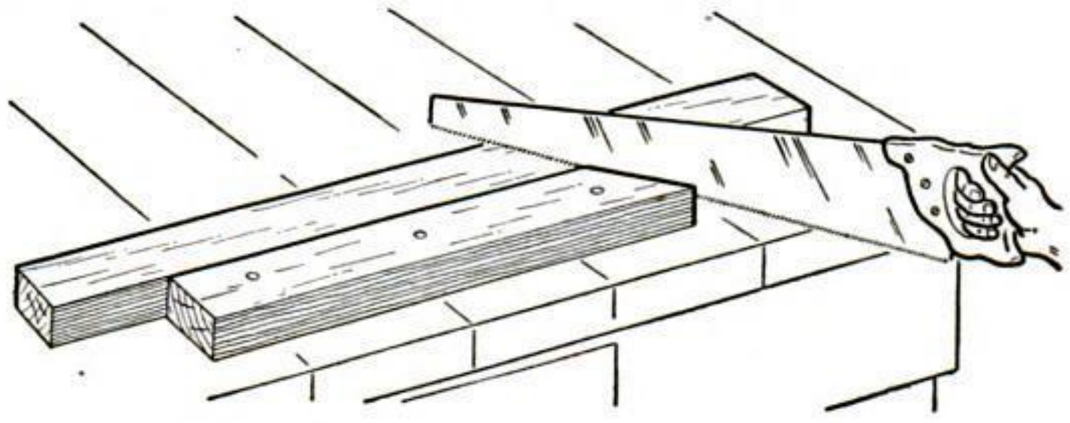
FILLED from the inside and collected from the outside, this bin keeps trash cans out of sight from the house, yet within easy reach for the collector. The lid keeps dogs from knocking the cans over.

Saw a 22″-by-36″ opening in the fence for the bin. Rear corners are joined by two-by-fours, which also serve as legs. The front rests on the lower fence rail.—*Hi Sibley, Nuevo, Calif.*



Wood Scrap Guides Miter Cuts

AN EMERGENCY miter guide can be quickly made from a scrap length of two-by-four. Cut one end to the desired angle, nail the piece to a bench or sawhorse and let the saw ride against the end to guide the cut. —*L. H. DeLong, Lake Wales, Fla.*



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[*Continued from page 182*]

checked the universal joints and ran the car in gear, studying the drive shaft.

Then he and Pederson took another run. The vibration was still there. Gus began to sweat.

Back at the garage once again, he checked the grease pack of the front wheel bearings, and proper bearing adjustment. He checked camber, caster, front suspension.

"Sometimes," he said to Pederson, "the manufacturers fail to pack front wheel bearings—not often, but it does happen. Now how about front-wheel and tire balance?"

"You check 'em," Pederson said. "I have."

Gus did check them. Wheels and tires balanced perfectly. Gus noted that Pederson had attached lead balancing weights here and there. He scratched his graying hair thoughtfully.

"Let's try her again," he said.

Gus pulled up at the pumps, beckoning to Stan Hicks..

"Put 50 pounds in these tires, will you, Stan?" he said.

"But, Gus," Stan protested, "you can't put 50 pounds in these tires. Factory spec calls for only 24."

"Sure," Gus nodded, "but let's ride on 50 this trip."

The Tires Balance

Once more on the open road, Gus watched the speedometer needle climb—50-60-70-75.

"No vibration," he commented.

"But I can't ask Madsen to scoot around the country on 50 pounds of air," said Pederson.

"Right." Gus's eyes twinkled. "We've tacked this vibration down squarely to the tires. The rest is easy."

"Easy!" echoed Pederson. "I can't buy that. Tires balance—remember?"

"Sometimes," Gus said, "manufacturers fail to build a tire right—not often, but it happens. It happens so seldom that I'd bet my hat there's just one guilty tire on this bus."

Gus pulled an air gauge out of his pocket. "We'll just let the air out of one tire at a time, down to 24 pounds, until the vibration comes back."

The Vibration Goes Away

Gus knew that one tire in 10,000 or more may have its ply laps laid together, instead of being separated. When this occurs it is a mechanic's vibration nightmare. The tire can be made to balance, but there is a hard spot that pounds the road at high speeds. When the tire is inflated, rock hard, the hard spot is no different from the balance of the tread, and vibration goes away.

Out on the road again, the ghost vibration came back as soon as Gus, after two tries, reduced pressure on the third tire to normal. Gus smiled triumphantly.

Back at the Model Garage, he replaced the tire, after cutting into it to prove his point to Pederson.

"You won't even be out the cost of a tire," he told the used-car dealer. "I handle this brand, and I'm sure the factory will be happy to replace this one."

That evening Alf Madsen drove in.

"I hear," he told Gus, "that you fixed this bus, after that knucklehead, Pederson, had monkeyed with it for weeks."

"Don't let the corporal kid you, Lieutenant," he said softly. "Pederson merely brought the car in here for an exchange on that faulty tire that was causing your trouble. Smart boy, that Big Bill."

Too Much Talk, Says Gus

Madsen's eyes carried suspicion. Then a slow smile formed around his lips.

"I've known you a long time, Gus," he said. "I think that you can lie slicker'n anybody I know, when you want to."

"And I," Gus told him, a twinkle in his eye, "used to hold your little pink nose so you could blow it, Lieutenant. I think that you've been talking too much and too loud lately."

"Maybe I have, at that," Alf Madsen said thoughtfully, as he drove out. "Thanks a million, Gus." END

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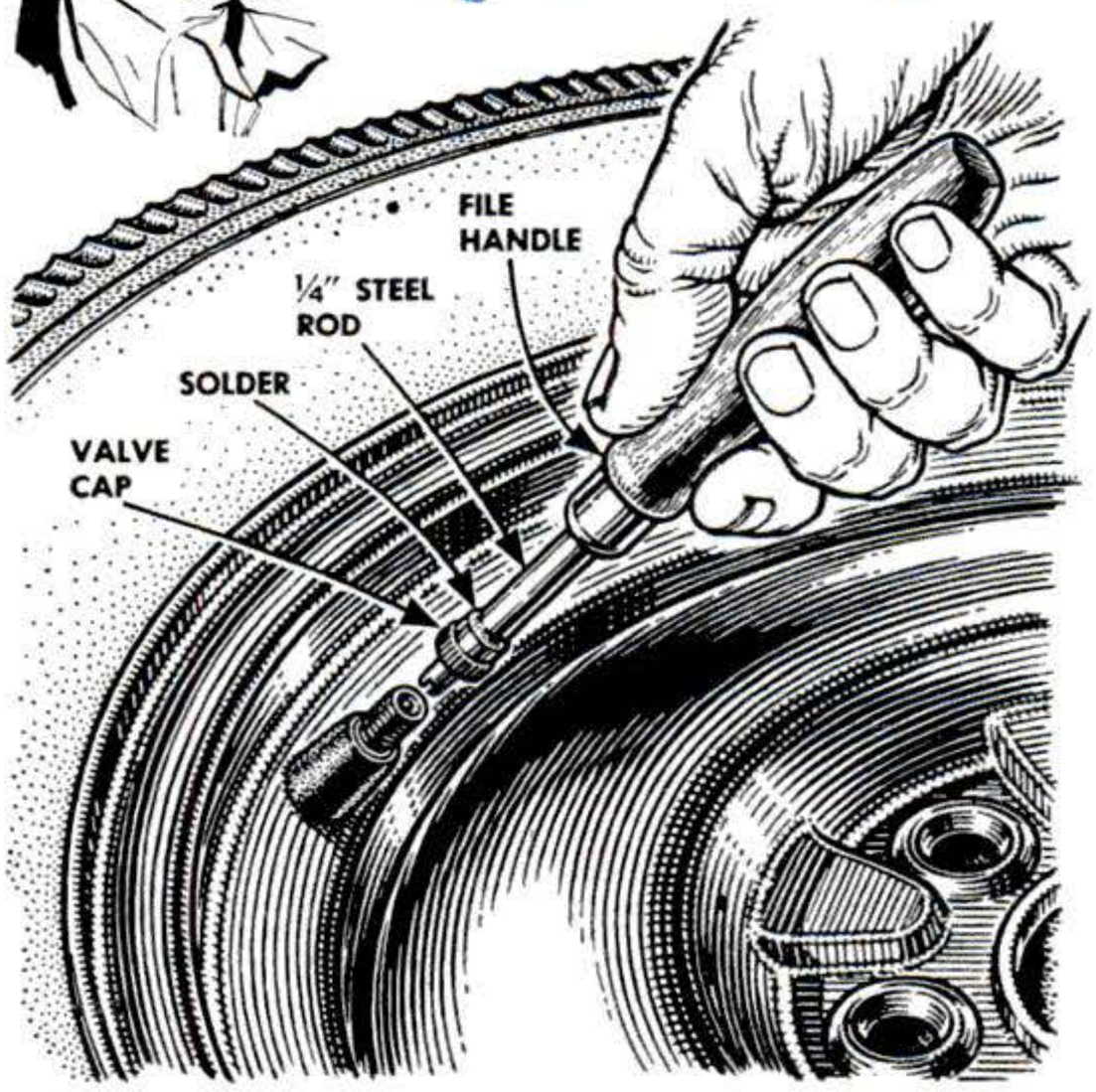
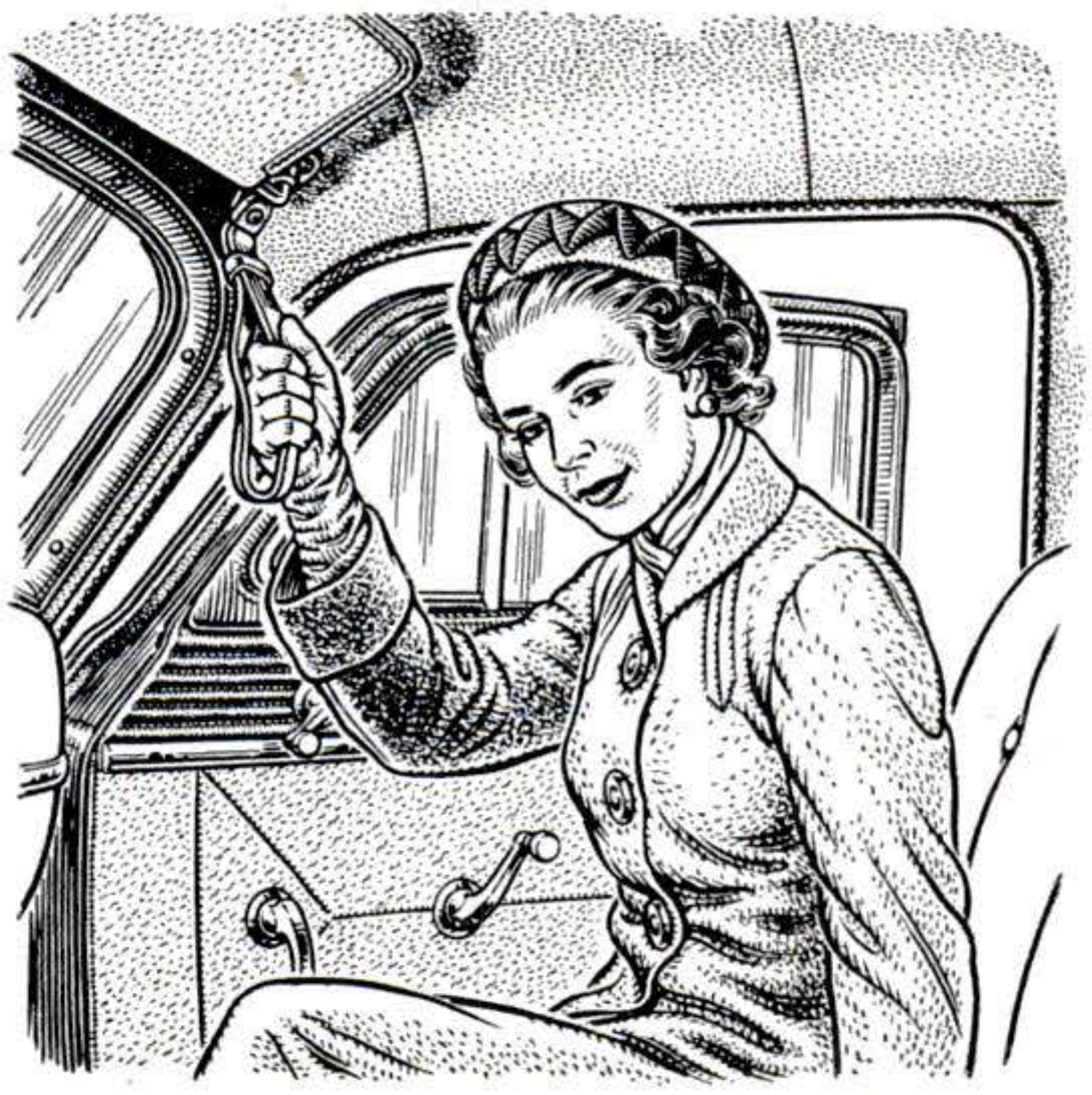
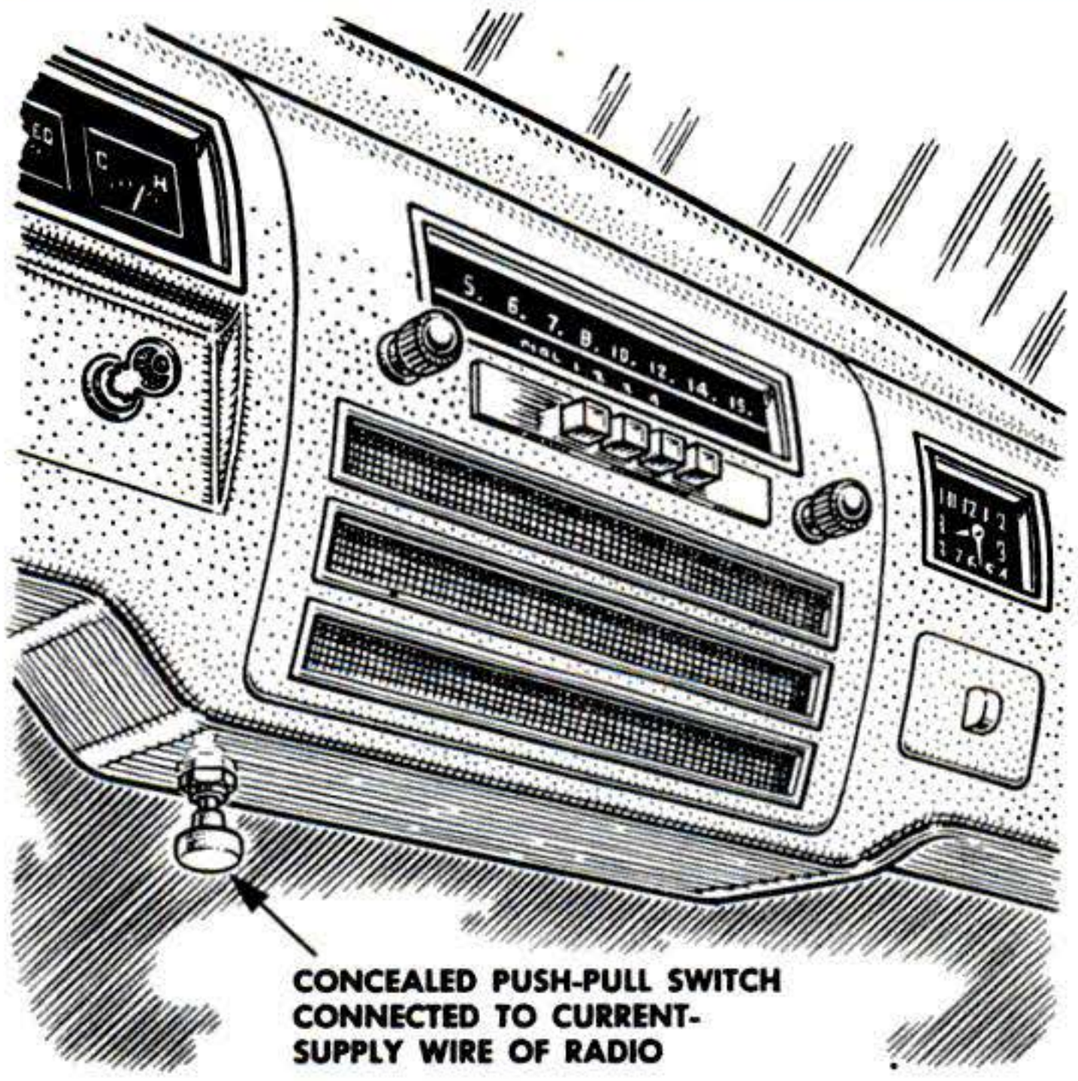
Hints FROM THE MODEL GARAGE



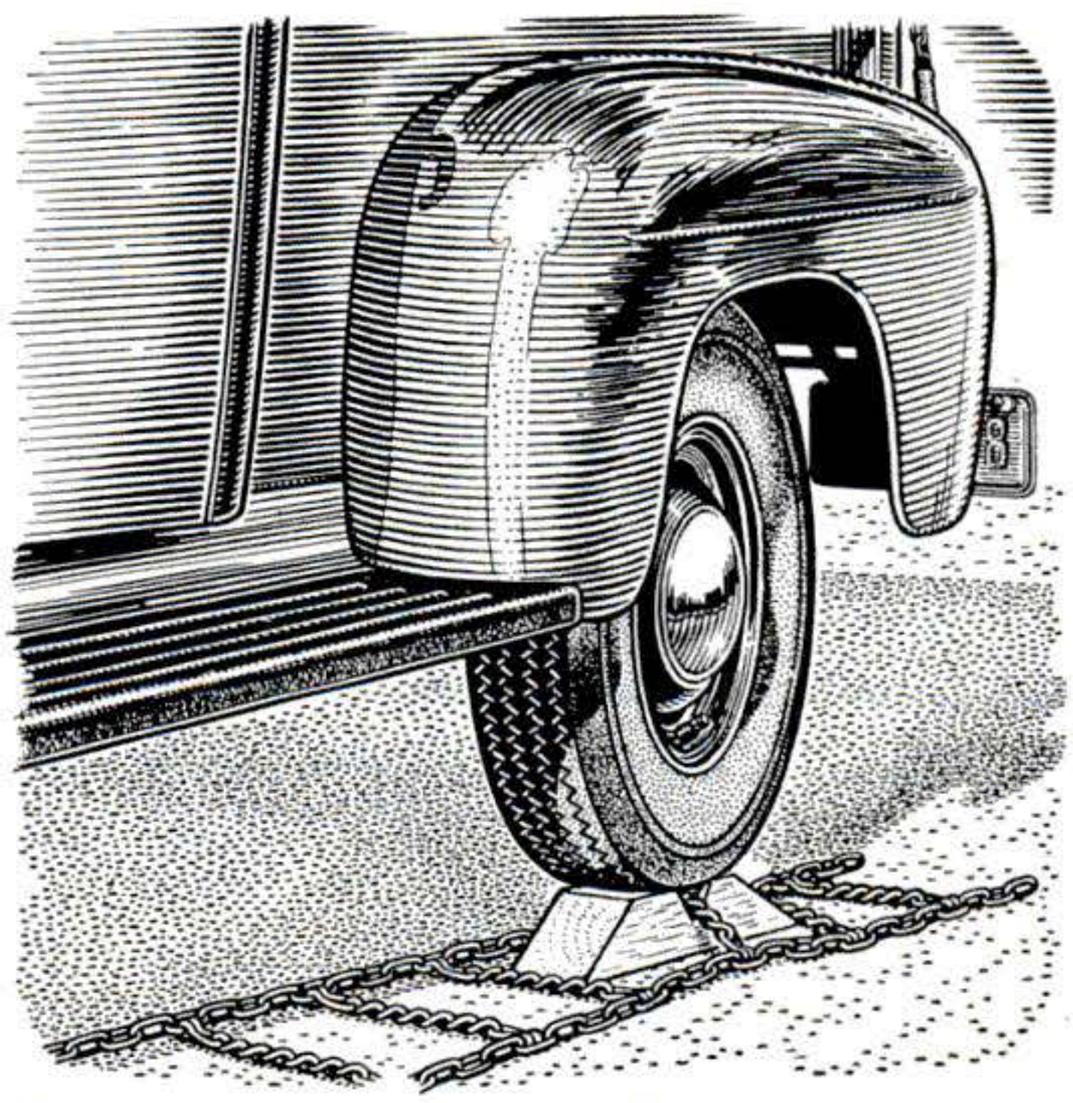
Valve cores can be quickly removed from tire tubes with this screwdriver-like tool. A valve cap—the kind with a core-extracting tip—is brazed or soldered to one end of a ¼" steel rod and a wood file handle is forced on the other end.



An extra hand strap added to the right front seat will make it easier to get in and out, and provide a handhold on rough and curving roads. Securing the strap to one of the screws that hold the sunshade bracket saves drilling new holes.



A car radio can be turned on and off without disturbing the volume control if you wire a separate push-pull switch in ahead of the regular one on the control. Position of the knob under the dashboard also helps prevent unauthorized use.



Tire chains can be quickly put on without jacking up the car with this ramp made from a 4"-by-4" notched in the middle. One cross link is laid in the notch and the wheel driven on top, leaving the chains loose at the bottom and easy to clasp.

Please turn the page for more auto hints.

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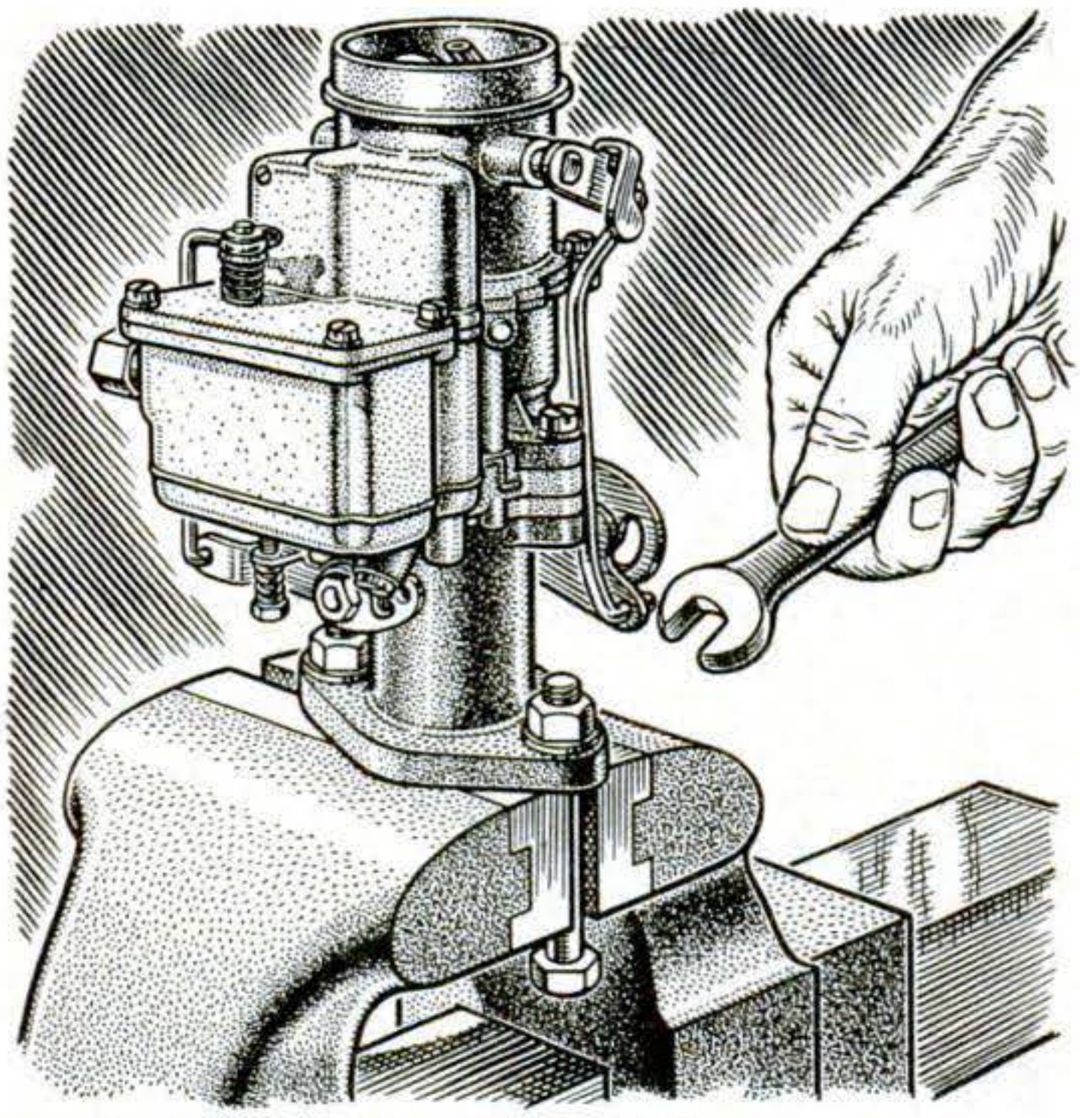
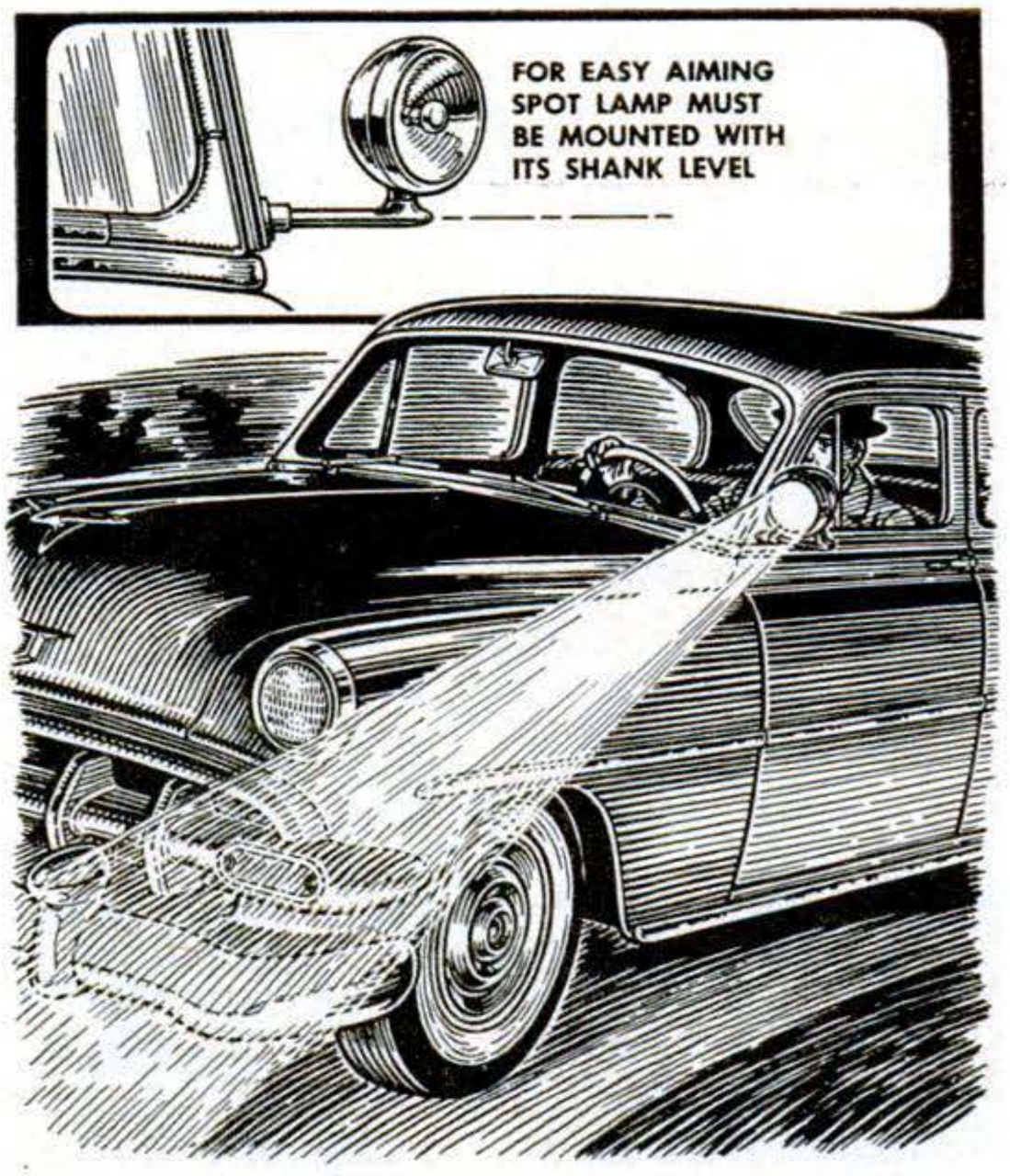
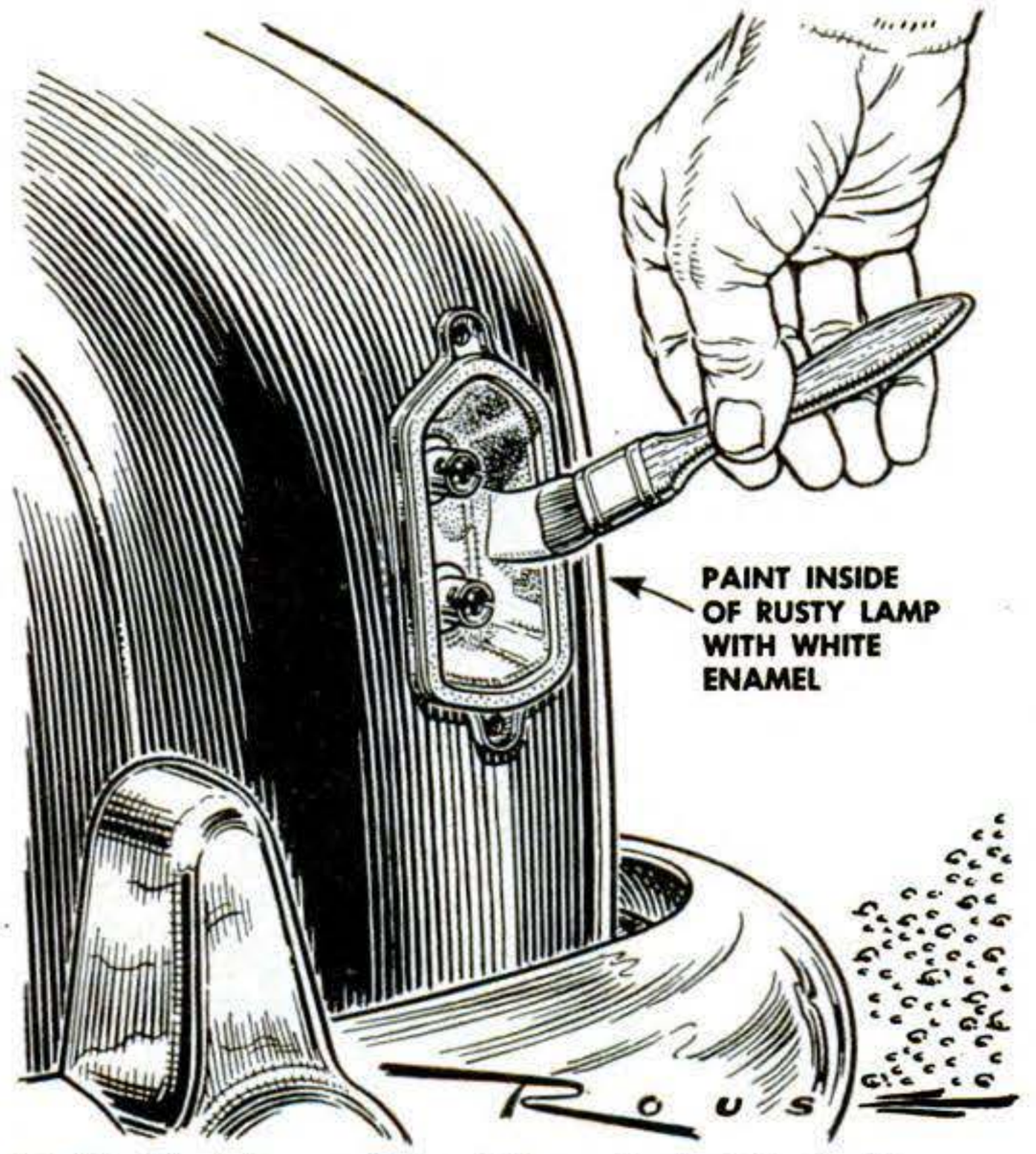
MORE Hints from the Model Garage



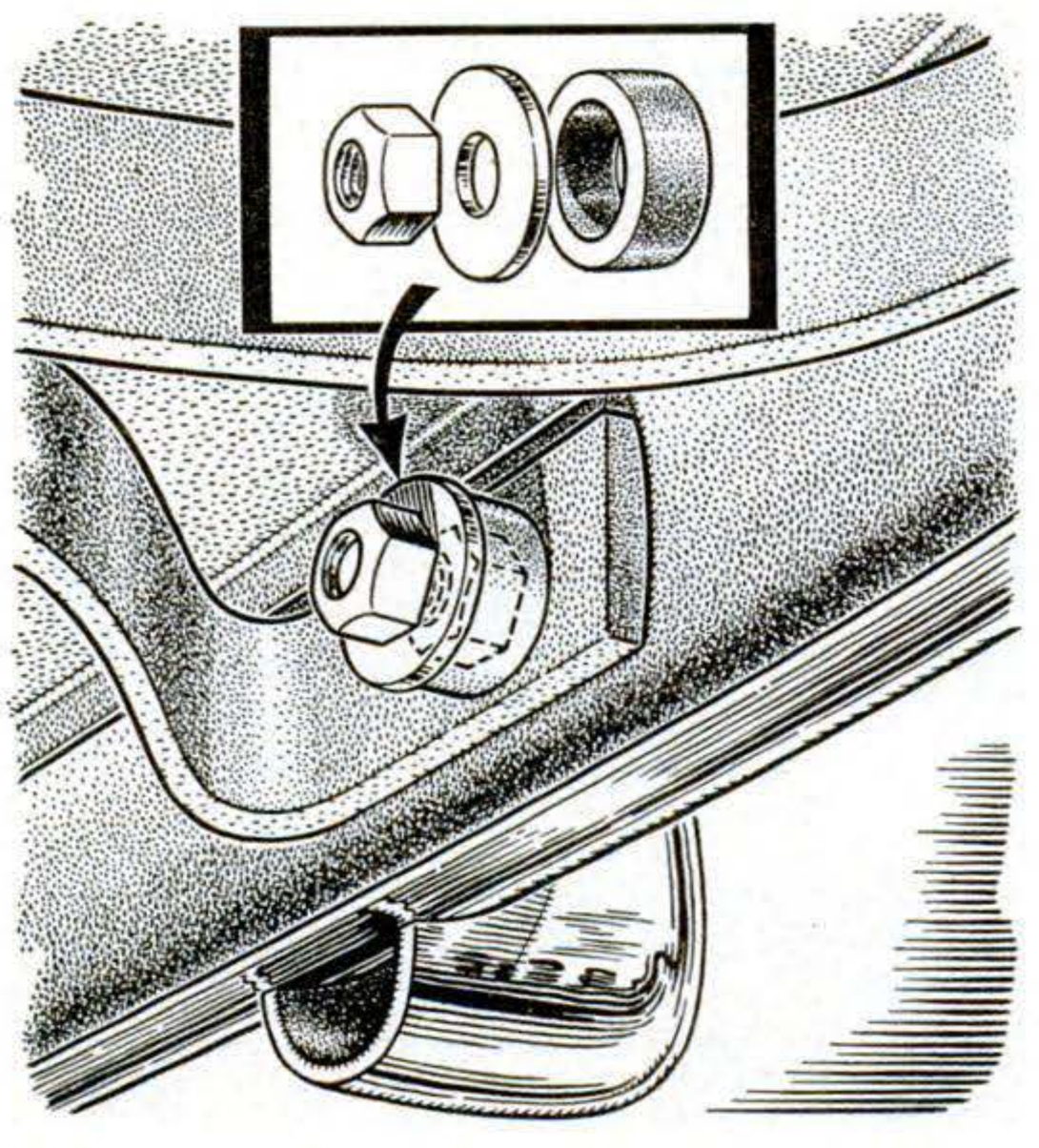
To hold a carburetor while you work on it, clamp two ⅜″ bolts in a vise and bolt the carburetor to these through the mounting holes in the flange. This will provide a very rigid work mount without danger of damaging the carburetor.



When mounting a spotlight, be sure to get the control arm level so the beam will stay level as you swing it. Wire the spotlight independently of the head lamps so that if the latter should fail, you still will be able to continue.



Tail lights will shine brighter if you paint the inside of the lamp receptacles with white enamel to increase their reflectivity. This is especially helpful on older cars where the housings have become heavily rusted. Clean the metal thoroughly before painting.



A frozen nut on a loose bumper guard can be bypassed this way on cars that have long guard bolts. Cut a short collar of pipe large enough to fit over the nut and slightly longer than the nut's thickness. Then add a new nut and washer and draw up tight against the collar.

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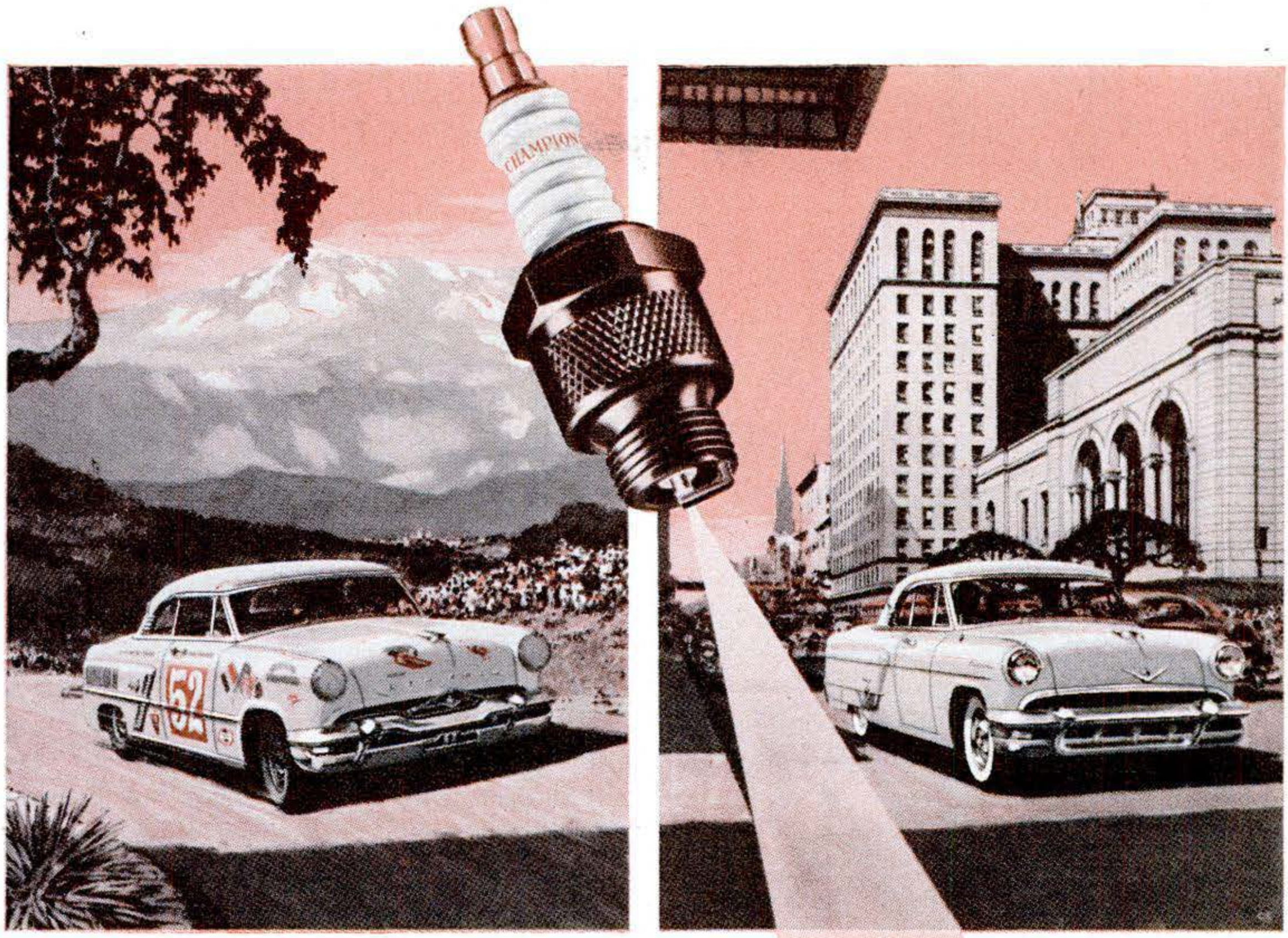
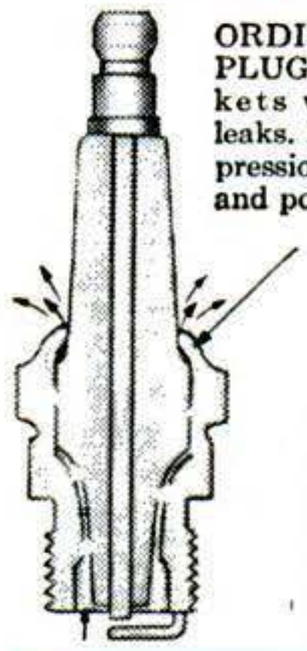


MEXICAN ROAD RACE OR HOMETOWN TRAFFIC, YOU'RE AHEAD WITH CHAMPION SPARK PLUGS!

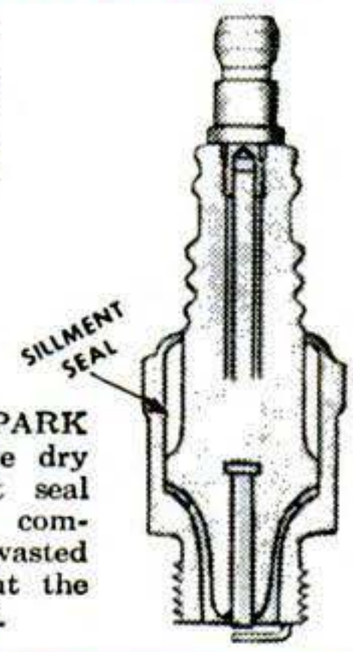
Today, because of higher compressions, good spark plugs are the key to top engine performance. With sweeping victories in the Mexican Road Race, Champion Spark Plugs *once again* prove their outstanding superiority under extreme driving conditions. Champions came through this gruelling 1,912-mile run with dependability and performance to spare—powering the winning Lincolns in the large stock class, the winning Lancia in the large sports class and the Chevrolet, winner of the small stock class. These were strictly stock Champions, identical with those available at your neighborhood dealer.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

ANOTHER CHAMPION FEATURE



ORDINARY SPARK PLUGS use metal gaskets which develop leaks. Result: lost compression, wasted power and poor economy.



CHAMPION SPARK PLUGS exclusive dry powder Sillment seal guards against compression loss and wasted power throughout the plug's service life.

CHAMPIONS *WILL MAKE ANY CAR RUN BETTER!*

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[Continued from page 136]

Burke. It lies at the end of a lovely bay of Lake Michigan, and among the forests and farms that stretch out for miles on three sides of it there are many lakes, all beautiful and all full of fish.

Burke began to feel better already.

Always conservative, though, he burned only half his bridges. He sold his home in Detroit, and he and Mrs. Burke bought a log cabin snuggled among pines and birches at the very edge of Traverse Bay.

He Made Hellgrammites at Night

But while his wife and one daughter moved there, Burke and his other daughter remained in Detroit, commuting 500 miles every weekend. He held on to his salaried job and turned out batches of corn borers, grubs and hellgrammites at night.

The Burkes sold $13,000 worth of lures in 1950, topping off with a spectacular finish at the National Hardware Show in New York. There, with a homemade display set up on a card table, Burke raked in $2,200 for his fish lures within a few days.

With such exhilarating evidence of the salability of phony fish food, Burke became his own boss. He launched his business with only $500 worth of materials and equipment.

Bedroom Doubled as Workshop

Throughout 1951, the log cabin beside Traverse Bay was both home and factory. By day, seven people, including Mrs. Burke, turned out fishing lures there. The lures were made in the utility room and spare bedroom, inspected and stapled to display cards in the dining room, packaged in the kitchen.

By 1952, when the annual sales of Burke's Flexo-Products, as they had now been named, reached $65,000, the company moved out of the log cabin and into four rooms in the basement of a Front Street drugstore.

One of that year's biggest orders came from Hollywood, and had nothing to do with fishing. Paramount was preparing to make a picture titled *Christopher versus the Ants.* One of the studio's executives had happened to see a display of Burke's lures, including a realistic red ant, in a local sporting-goods store. He suddenly wondered what it would cost to buy 500,000 of them, and had an aide telephone Burke to find out. Burke, by then hardened to the fact that Traverse City breeds practical jokers as well as fish, was inclined at first to regard the whole matter as a gag. But the static-shrouded talker in Hollywood was convincingly earnest. The final order, though watered down, was still huge. It called for 100,000 ants twice natural size and for 5,000 of them four times natural size. Furthermore, they all had to have steel shot in their noses, so that they could be moved about by hidden magnets.

Business Looks Good for '54

This year there is every evidence that Burke will sell at least $100,000 worth of his plastic lures, which now contain 19 different models. A new minnow, a stone-fly nymph and a floating frog are soon to be added to the line.

Though Burke still uses the same basic plastic powder with which he started, he has steadily improved the mixing and curing formulas to improve the flexibility, color fastness, clarity and strength of his lures. Their color is remarkably natural, and Burke won't tell how he achieves it, for patents on the process are still pending.

The final test of any lure is whether it will catch fish, and Burke has delegated to himself the pleasant task of finding that out. He has tried his lures in the Boardman River, which flows past his office door; in California; in Canada; and in Duck Lake, a few miles back of Traverse City, where he has a cottage called "Burke's Retreat."

Here, while fat, inquisitive gulls drop in from Lake Michigan to observe the size of the catch, Charlie Burke happily conducts his research. END

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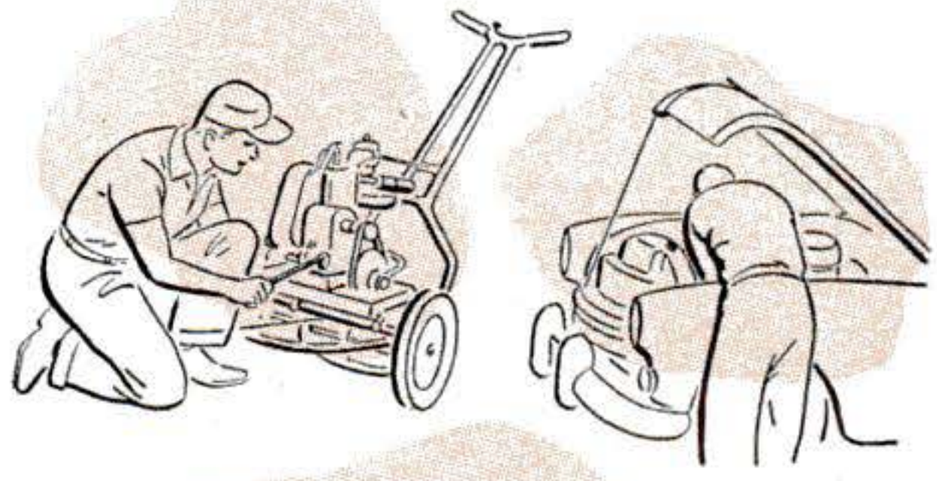
Start your collection of FINE TOOLS

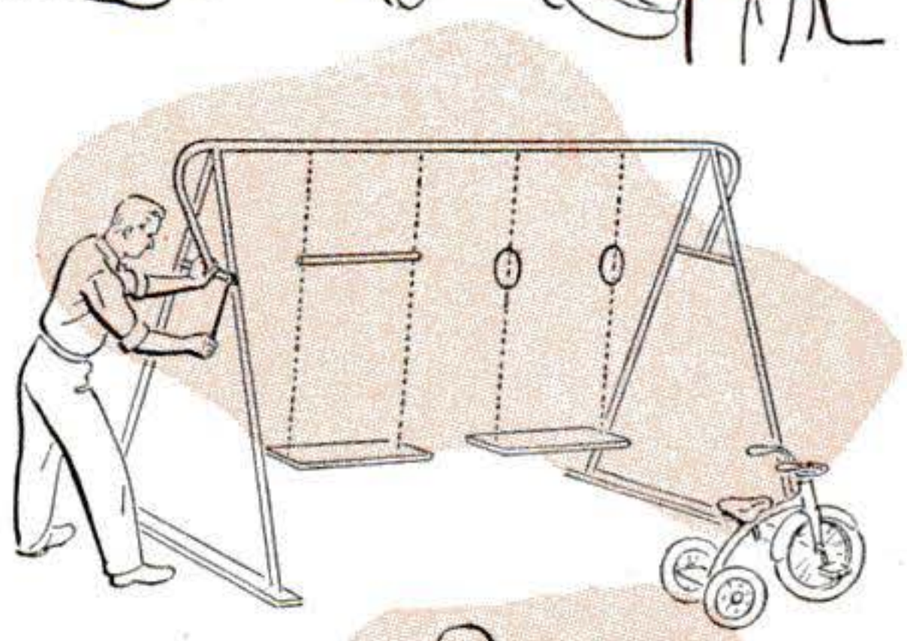
with this

BONNEY SOCKET SET!

Here's the most practical basic socket set for home and shop. It contains twelve of the most useful ½″ square drive double-hex sockets, together with a 15″ hinge handle and an 8″ cross handle. Available in either a cardboard or metal box.



With this Bonney Socket Set, you can make quick work of repairs and adjustments on lawn mowers and garden tractors, automobiles, washing machines and other household appliances.



Take a tip from professional mechanics who call Bonney wrenches America's finest—make Bonney *your* choice. Start with a Bonney No. AA8 Standard Series Socket Set. Then add to your collection of *fine* tools from time to time by buying the Bonney wrenches *you* find most useful. They're available in open stock or complete sets. Ask your dealer for Bonney. If he doesn't have the No. AA8 Socket Set in stock, he can get it for you. Or write us direct.

BONNEY TOOLS

Note! The economy-minded home mechanic or hobbyist will find Bon-E-Con tools especially suited to *his* requirements. They are tools any man would value at prices anyone can afford. And Bon-E-Con tools carry the same guarantee as Bonney tools.

BONNEY FORGE & TOOL WORKS, ALLENTOWN, PENNSYLVANIA

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Choosing the right projector for your family color shows

IF you're a color slide fan—or about to be—you know that color slides are rewarding for yourself and enjoyable for your family, too. Yet much of the pleasure you receive depends on the projection device you buy.

Projector, table viewer . . . or both?

Naturally, you don't need a high-powered auditorium-type projector for a small living room. And it takes more than the minimum-powered projector to do a job, say, in a large family recreation room. It's possible you'd be just as happy with a table viewer as with a large picture projected on a large screen. Many color slide fans have both—a projector for a family show, and a table viewer for "quickie" showings or editing slides in the living room under normal light.

Get a demonstration

When your dealer demonstrates the Kodaslide Projectors and Table Viewers shown on the opposite page, you'll find they flood your color slides with brilliant light, even to the extreme edges of the picture. You'll see each detail crisp and clear, thanks to unique optical systems developed by Kodak optical engineers. And slide changing is easy—even in darkened rooms.

Your Kodak dealer is there to help

Talk with your Kodak dealer about your personal needs—have him demonstrate—and you'll find it's easy to choose the right slide projector or viewer.

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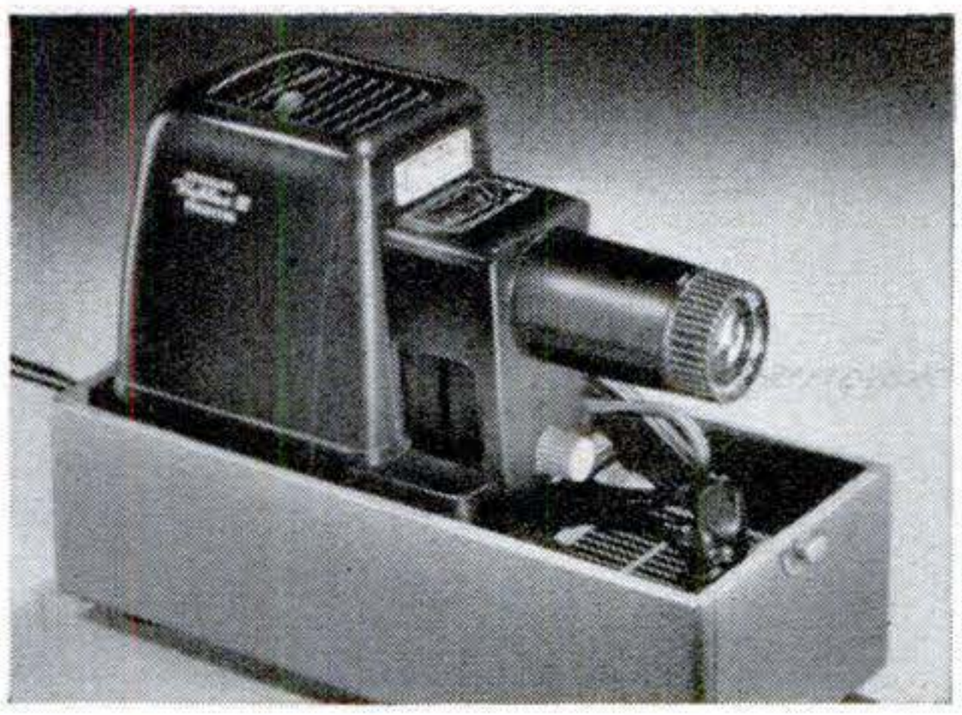
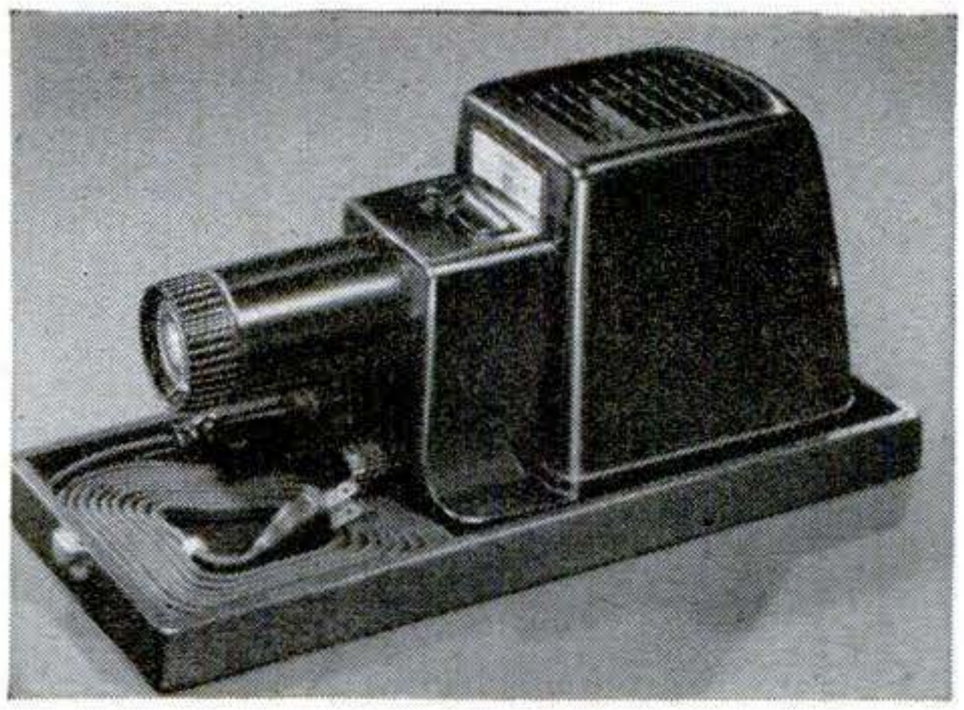
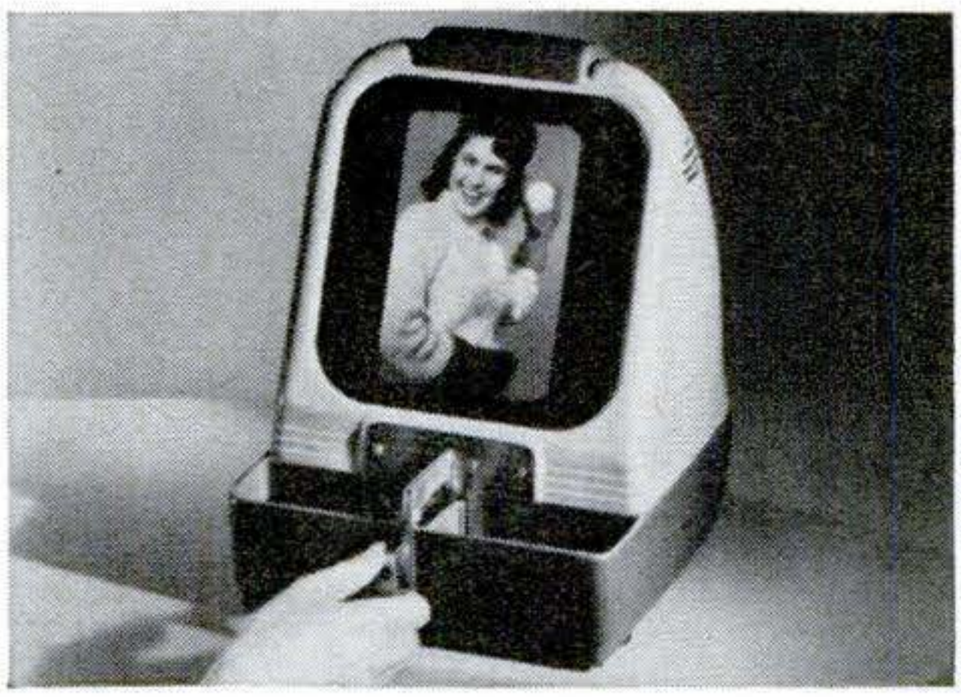


Kodaslide Highlux III Projector—Has a brilliant optical system, powerful 300-watt lamp; gives new life to your color slides. Quiet motor-driven blower cools slides. New-type slide feeder in top prevents jarring instrument when changing slides. $56.50. Highlux II is 200-watt model without blower. $36.50.

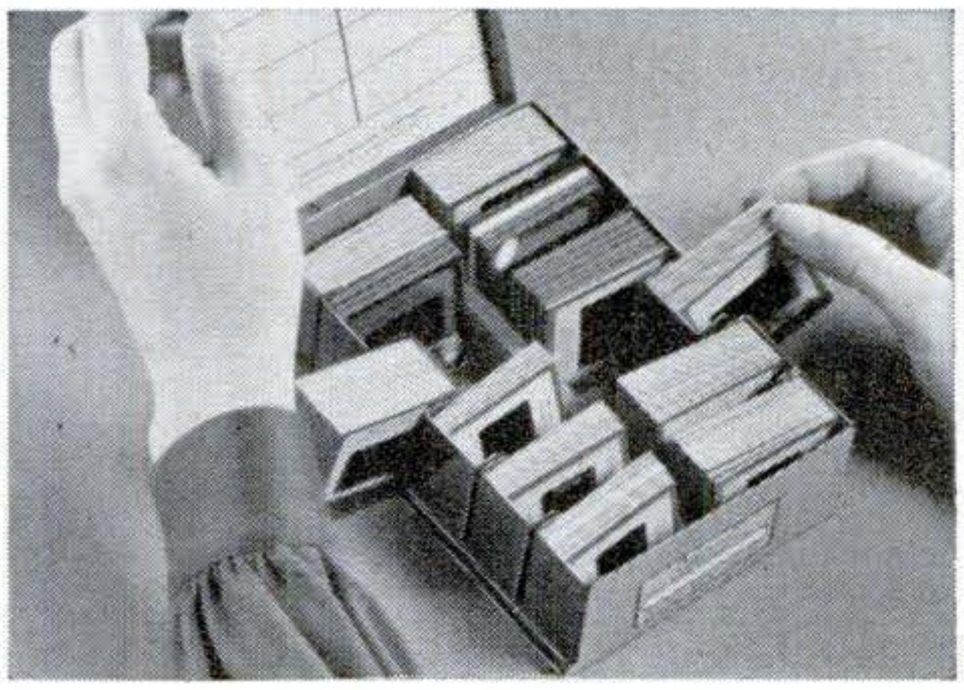


Economy projector—Kodaslide Merit Projector shows your slides with bright, even illumination. Aluminum baffles keep slides cool. Built-in elevation device, easy to operate. Slide-feeding on top prevents jarring instrument. Includes fine Kodak Projection Ektanon Lens, 5-inch *f*/3.5. $24.65.

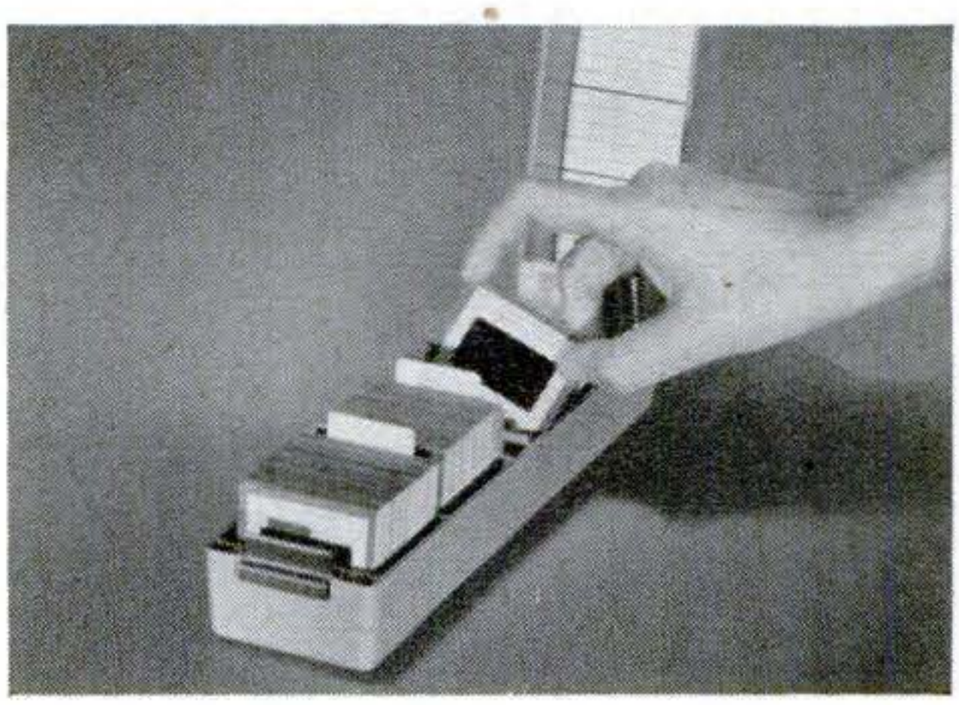
For small group showings—Kodaslide Table Viewer 4X combines projector and screen in one handy unit. Enlarges color slides more than 4 times, shows them brilliantly even in lighted room. Only $37.50.



Deluxe viewer—Kodaslide Table Viewer, Model A, has Day-View Screen for brilliant images. Takes 75 cardboard or 30 glass slides. Push-pull changer advances slides, turns light on and off, restacks slides. $97.50.



Easy way to store slides—Kodaslide Compartment File has 12 handy swing-out compartments. Stores 240 cardboard or 96 glass slides. You'll appreciate the handy index inside cover for subject reference. $3.94.



New file for an evening's show—Kodaslide Ready-File is compact, handy for carrying. Holds 200 cardboard 2 x 2 mounts or 100 stereo cardboard mounts. Keeps slides in groups, the way you project them. Index in cover. $1.95.

Prices are list, include Federal Tax where applicable, and are subject to change without notice

Eastman Kodak Company, Rochester 4, N. Y.

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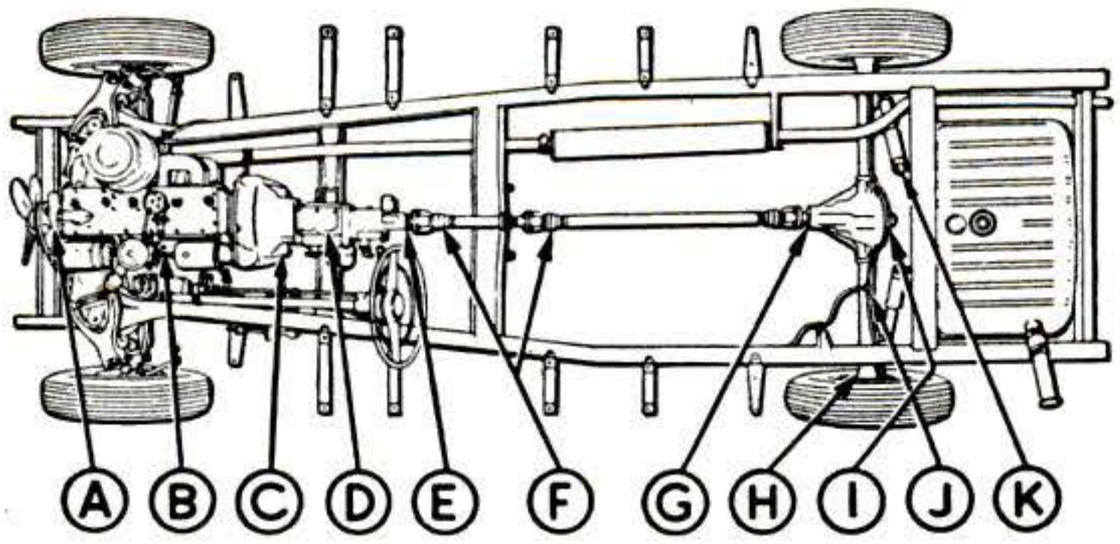
Care and Feeding of Engines

BY S. P. CORP

LOOKING FOR OIL LEAKS

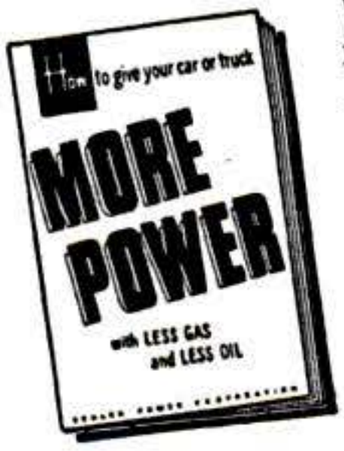
After a long cold winter, gaskets may shrink, bolts may loosen, oil may leak on your garage floor. It is important to locate these leaks and correct them.



A. May require a new timing chain oil seal or new oil pan gaskets.
B. New oil pan gasket.
C. If engine oil, a new rear main bearing oil seal may be needed. If oil is black and heavy, you may need a new transmission front bearing oil seal.
D. Transmission oil leaking here may call for a new transmission cover gasket or a new speedometer drive gear oil seal.
E. Transmission oil here calls for a new transmission rear bearing oil seal—also indicated by oil thrown across the under side of the car body.
F. You may need to replace the U-joint rubber boot.
G. Oil leaking from front of rear axle calls for replacing the pinion shaft bearing oil seal.
H. When inside of wheel is covered with axle oil, the outer end of the axle oil seal needs replacing, lest it cause brakes to grab, which is dangerous.
I. May require rear axle inspection cover gasket, or merely tightening the plug. If filler plug ferrule is loose in housing, spot welding is needed.
J. Rear axle oil leaking at hydraulic brake fitting may call for removing brake liner and tightening or replacing fitting; then bleed brakes.
K. Oil leaking from shock absorber usually calls for replacing the whole sealed unit.

Watch for oil leaks and correct them, as oil can cause costly damage on parts where it doesn't belong.

YOURS FOR THE ASKING



Write for your free copy of the helpful illustrated manual, "MORE POWER, Less Gas, Less Oil." It may save you real money. And when you re-ring, insist on Sealed Power KromeX Ring Sets, with chrome top compression ring, chrome rails on oil ring, and the famous Full-Flow Spring. KromeX Ring Sets are factory-seated for fast break-in and immediate oil control. Sealed Power, Dept. H-3, Muskegon, Mich.

Sealed Power
PISTON RINGS

Patients Enjoy This Hospital

[Continued from page 128]

hampers for linen disposal, and X-ray view boxes.

Staggered between stations are sterilizers, stoves, refrigerators and supply depots. "Whatever you need," said Nurse Brown, "is stored where you need it."

Waldorf-Like Wards for Convalescents

But gadgets and architecture are not the only steps forward in the Kaiser Hospital. There's a difference in attitude, especially noticeable on the hospital's sixth and seventh floors. These are called "hotel floors," and are for convalescents.

On a typical sixth-floor morning, for example, Raymond Hayes wakes from a deep sleep, yawns and flips a switch at the head of his bed. "Desk," comes from the speaker over his head.

"Good morning," says Mr. Hayes. "What time is it?"

"8:25," says the speaker.

"Lovely morning," says Mr. Hayes. "I think I'll take my breakfast in the lounge."

"I'll tell the maid," says the speaker.

Later, after a brisk shower in his private bathroom, Mr. Hayes samples his bacon and eggs from a special vacuum-packed tray. "This," he says as he watches his favorite television newscaster, "is what I call the country-club life."

Trip to Surgery Made Less Dreary

Surgical patients have all the conveniences offered to new mothers, with the exception of private instruction on the care of Baby, and they have a few benefits of their own.

They are wheeled into surgery through back doors, so that they see very little of the mechanics involved and cannot see other patients. Instead of the usual wheeled stretcher, the patient arrives on a special recovery bed. After the operation is over, he is lifted directly from the table onto his bed, saving an awkward step in the usual routine.

Instead of being taken to his own room

[Continued on page 264]

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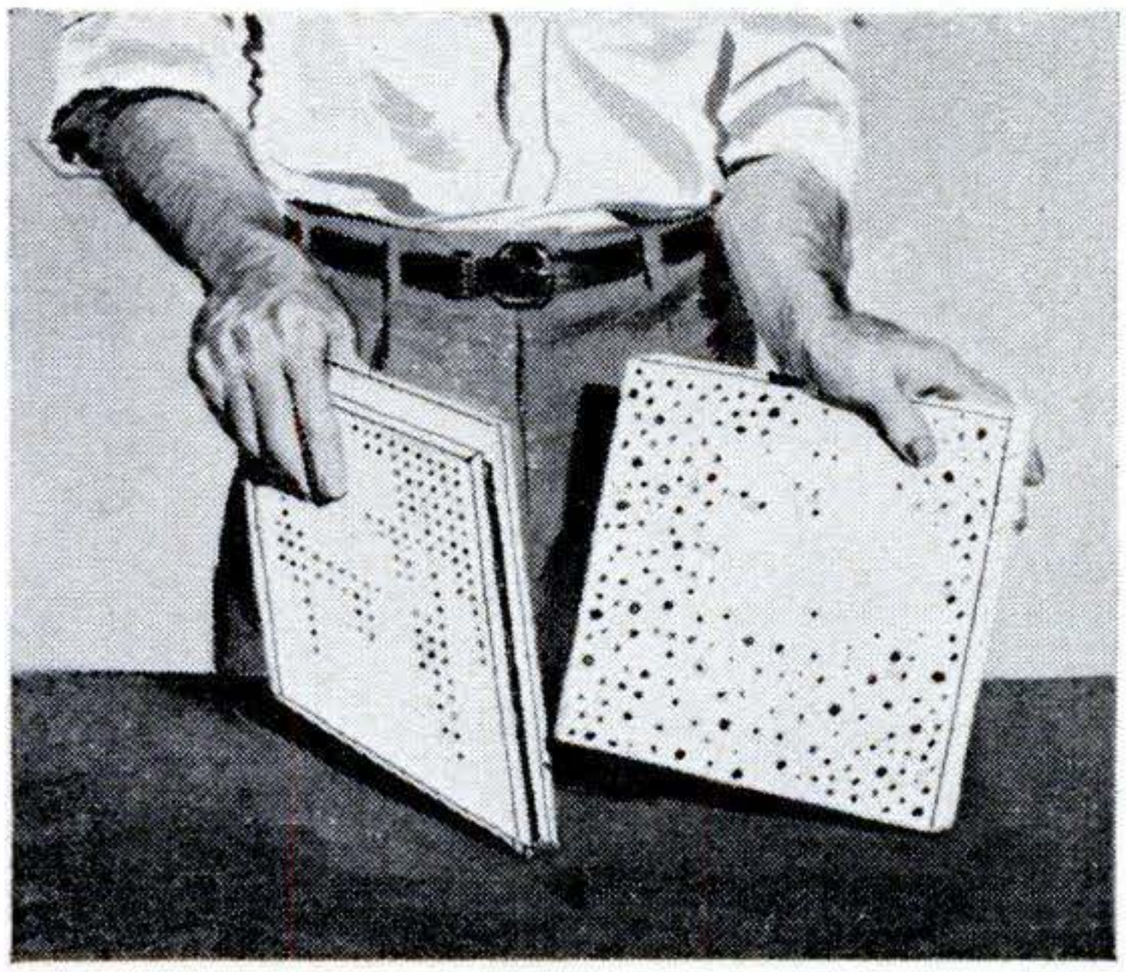
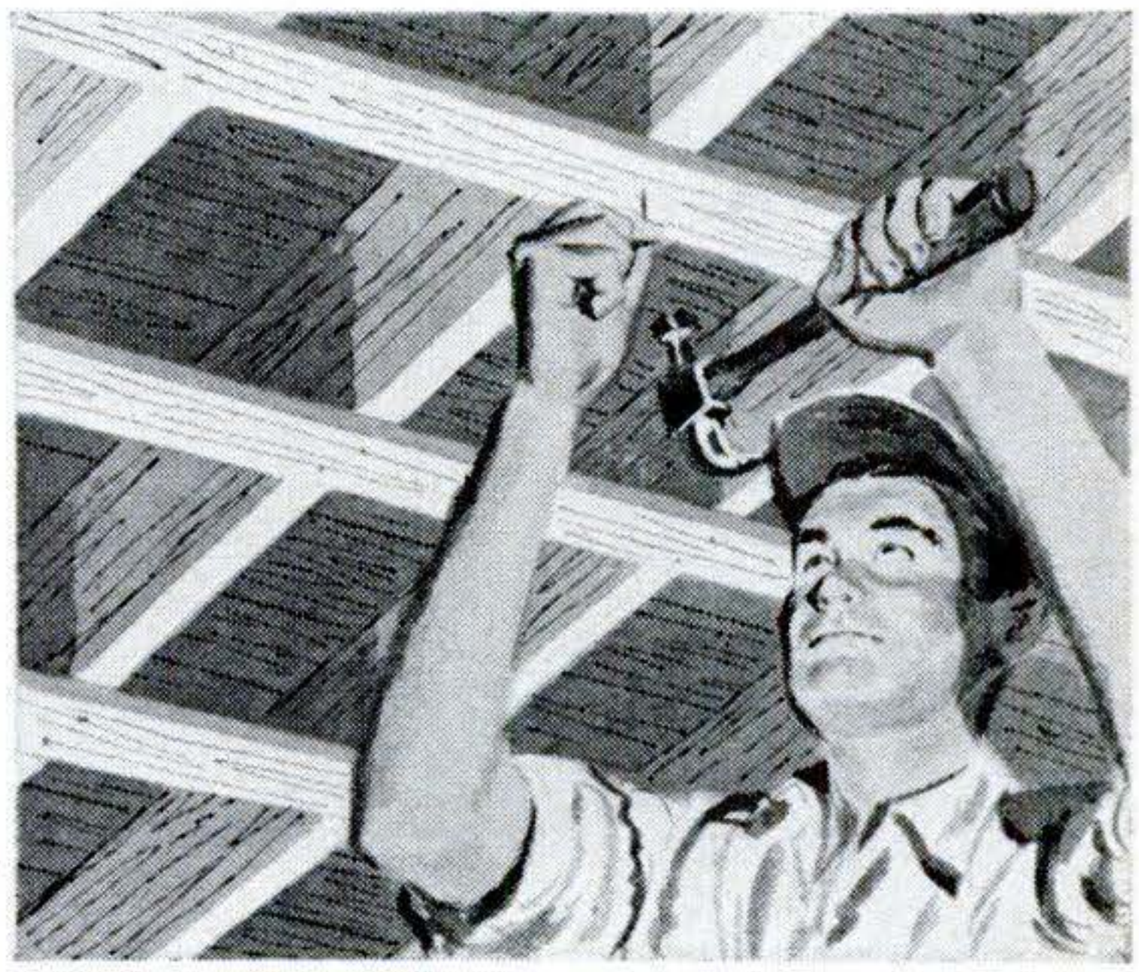
How to reduce workshop noise

It's easy to turn your workshop ceiling into an efficient sound-muffler by installing Armstrong's Cushiontone or Perforated Temlok Tile. These perforated wood fiber tiles absorb noise as it strikes the ceiling. You can install these noise-quieting tiles yourself.

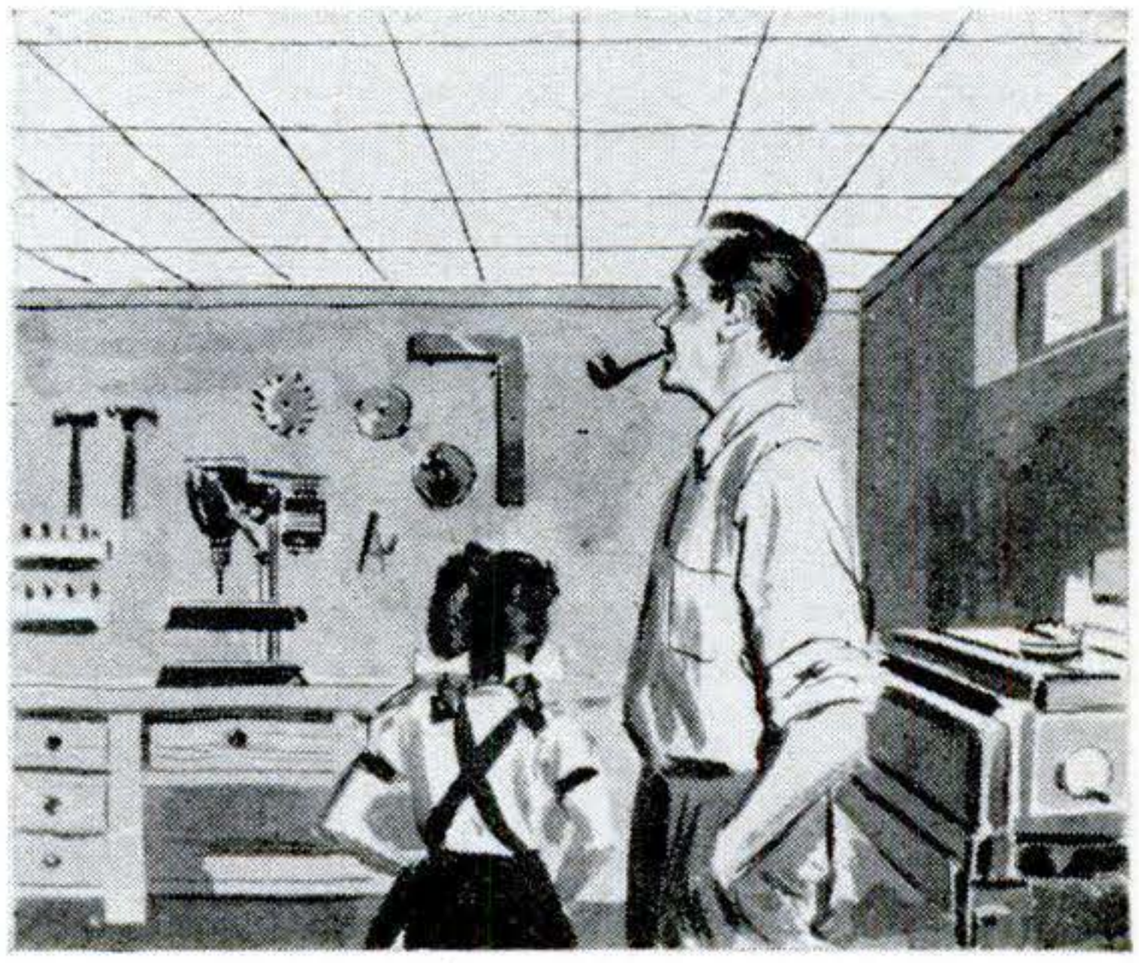


1 Your choice of two materials. Armstrong's Cushiontone, which comes in the attractive Full Random design, absorbs noise most effectively. Perforated Temlok Tile—besides reducing noise—is the easiest and fastest to install.



2 Furring strips provide a base for installing tiles. Start by nailing seasoned wood furring strips at right angles to joists on 12" centers. Wood furring should be smooth, level, and solidly nailed. Shim where necessary to produce a level surface.

3 Shallow-drilled holes in each corner of Cushiontone take flathead or collar nails. Nailheads should be $\frac{1}{8}$" to $\frac{5}{32}$" in diameter. Wide nailing flange on Perforated Temlok Tile allows for nailing or stapling. Special joint hides nails or staples.



4 In a few hours you can install an attractive, noise-quieting ceiling of Cushiontone or Temlok Tile in your basement workshop. Both tiles are prepainted and washable. You'll want sound-conditioning ceilings in your playroom and kitchen, too.

For a free booklet on Armstrong's Cushiontone and Temlok, write Armstrong Cork Company, 3903 Washington Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S CUSHIONTONE

Temlok® • M-67® Monowall® • Insulating Wool • Hardboards • Cushiontone®

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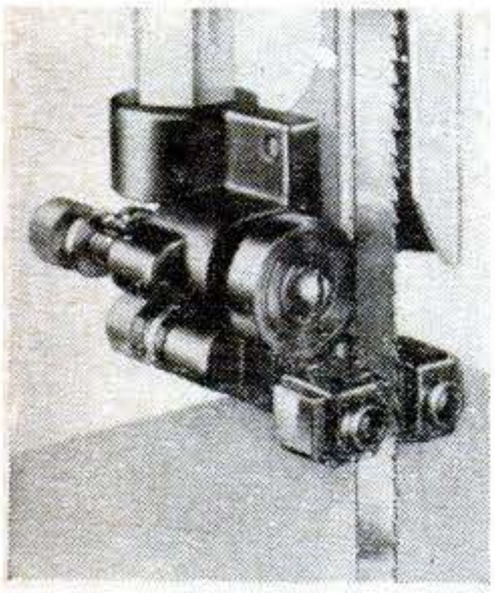
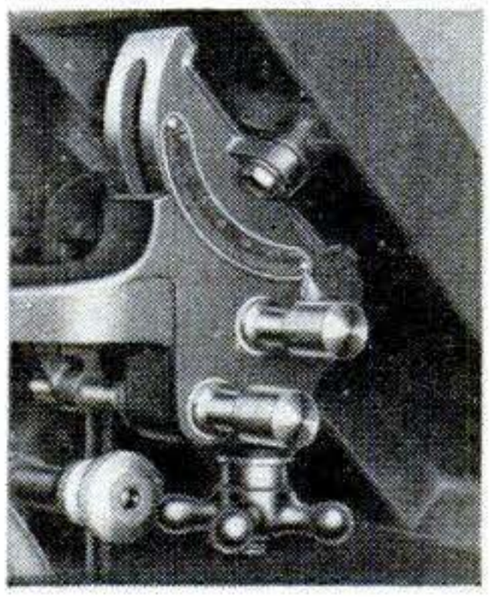
What You Could Do With

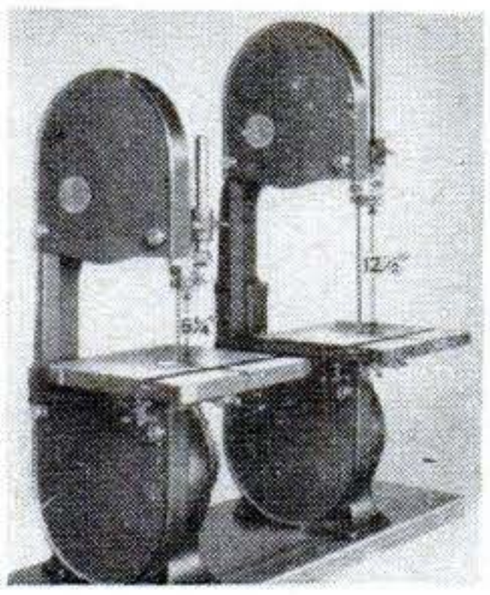
DELTA 14" BAND SAW—used in leading industrial plants for its accuracy, long life, and quick availability of parts and accessories. Built to high precision standards, but not high priced. See it demonstrated at your nearby Delta Dealer's.



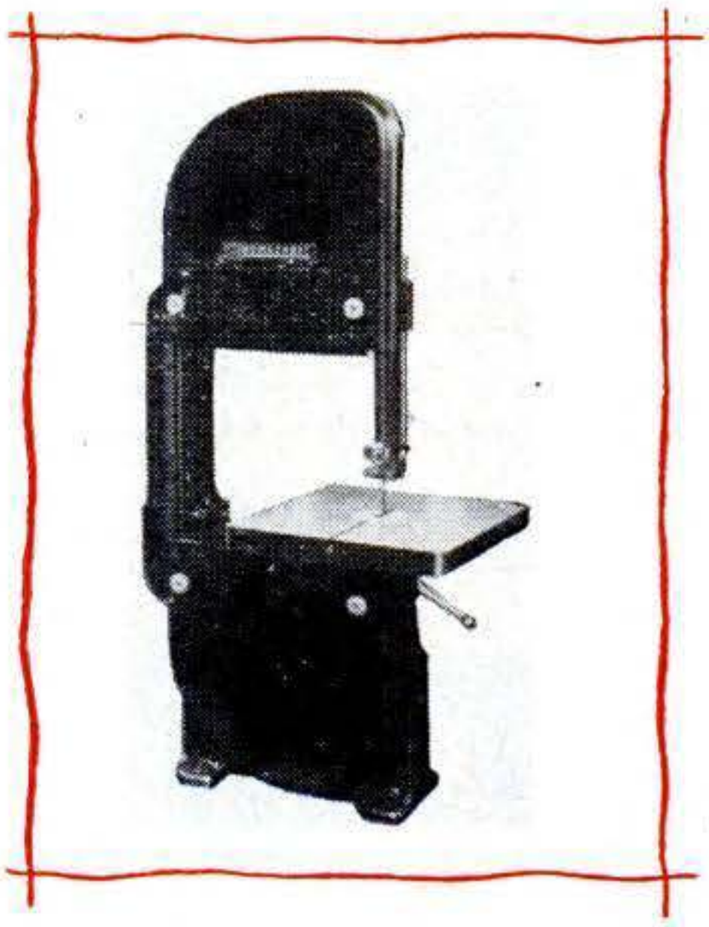
Micrometer adjustments of blade guides make possible accurate work, yet allow blade to run free. Guides and blade supports adjust independently.



Big table tilts 45° right and 10° left. Braced by two massive trunnions for maximum rigidity to support heavy work—an exclusive Delta feature.



Height attachment accessory—exclusive with Delta—increases the capacity of your Delta 14" Wood Cutting Band Saw from 6¼" to 12¼" under the guide.



Delta Homecraft 10" Band Saw

Finest saw made for the smaller home shop. Rugged, accurate—cuts 6" in hardwood smoothly. See it at your Delta Dealer, or at leading department and hardware stores.

DELTA MILWAUKEE

DELTA QUALITY MAKES THE DIFFERENCE!

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This DELTA Band Saw!

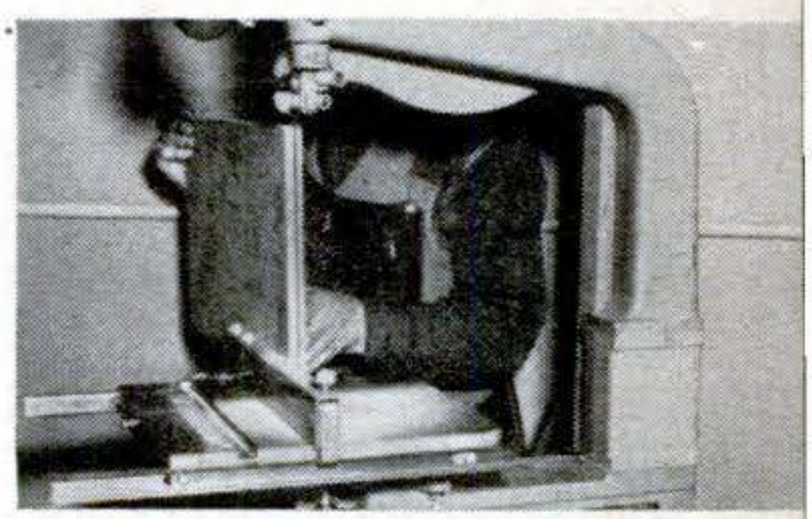
Make complicated curved cuts easily, in wood or plastic . . . re-saw accurately . . . rip, cross-cut, or miter-cut stock too thick or wide for your circular saw . . . do and make countless things that were before impossible! Once you own a band saw, you'll wonder how you ever got along without it—*if it's a Delta.*

Delta Quality Makes The Difference

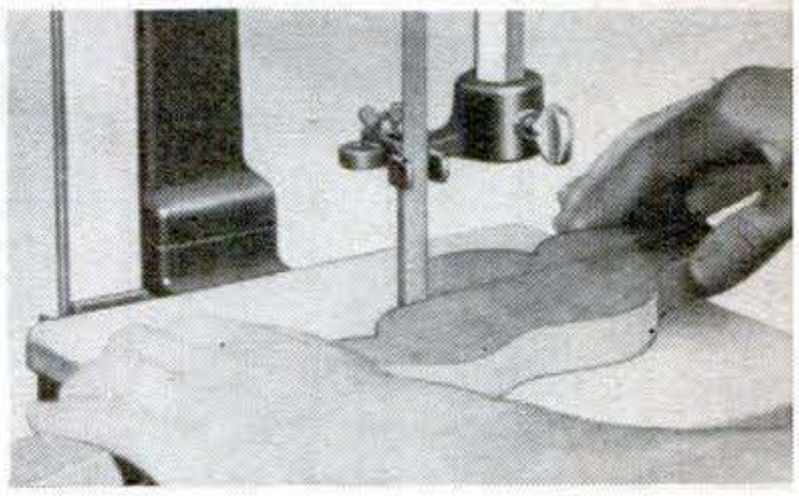
Into every Rockwell-built DELTA Band Saw goes all the experience, the precision-accuracy—all the solid quality—that have made Delta Power Tools leaders for exacting industrial use. In fact, the 14″ Delta Band Saw pictured at the left is the same model used in countless modern production plants. It's built to last, simple to adjust, foolproof to handle—and *safe.* Delta-engineered accessories make the versatile band saw even handier to have around, add a lot to your fun and satisfaction, save you more money by allowing you to do more jobs.

Delta quality costs no more than "second best"—so why gamble your money? See the Delta Band Saw demonstrated; ask your dealer about his easy-pay plan. And send the coupon today for helpful Delta literature.

Make hundreds of different curved cuts quickly and easily for professional-looking furniture, toys, etc. Precision Delta workmanship makes it easy to follow lines on difficult cuts.



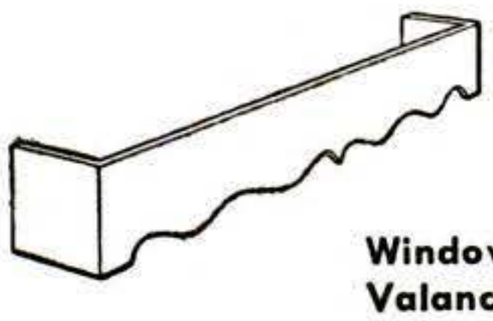
Re-saw accurately, rip and cross-cut stock too big for other saws. **With Delta Height Attachment accessory you can increase capacity from 6¼″ to 12¼″ under the guide—an extra offered only by Delta!**



With the handy Sanding Attachment—exclusive with Delta—it's simple to give that all-important professional finish to edges, roll curves and other hard-to-get-at places. Makes your Delta Band Saw more useful than ever.

Hard cuts are easy—on your Delta Band Saw

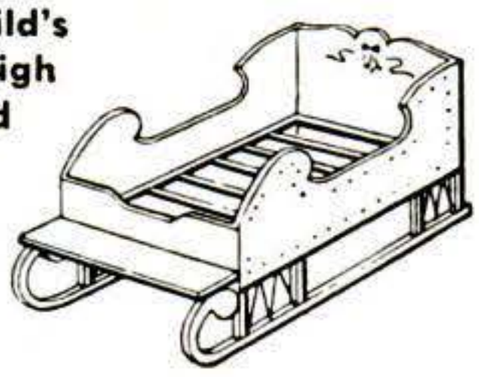
Make dozens of interesting new projects



Window Valances

Modern Chairs

Beach Shoes



Child's Sleigh Bed

DELTA QUALITY POWER TOOLS

Another Product by ROCKWELL

DELTA POWER TOOL DIVISION
Rockwell Manufacturing Company
504C N. Lexington Ave., Pittsburgh 8, Pa.

Please send me:

- ☐ New Delta Homecraft Catalog
- ☐ Delta Industrial Catalog
- ☐ "Getting The Most Out of Your Band Saw" (50¢ enclosed)
- ☐ "Things To Make On Your Band Saw" (25¢ enclosed—no stamps, please!)

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Address _____

City _____ Zone _____ State _____

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Animals Protect Themselves

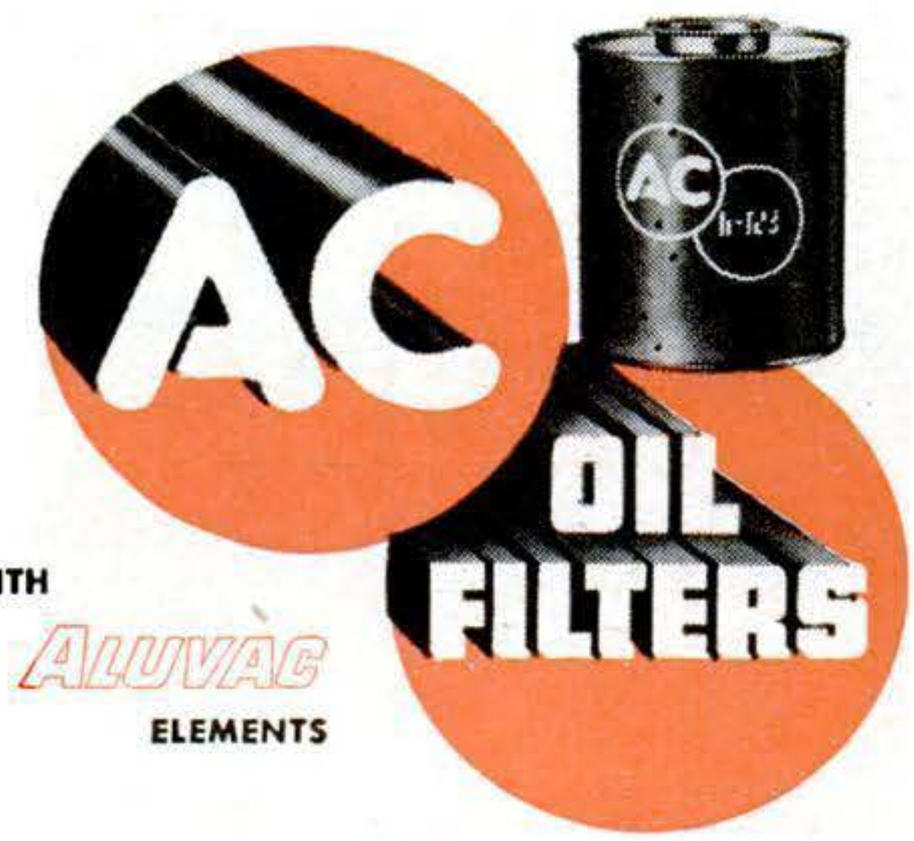
Normally of a very timid nature, a Doe will fight ferociously and effectively to protect its Fawn against attacks of Rattlesnakes and other natural enemies.

AC *ALUVAC* PROTECTS MORE NEW CAR ENGINES THAN ANY OTHER BRAND

Every car engine has its natural enemies too—the dust, dirt, grit and sludge that collect in motor oil—ready to attack smooth-surfaced bearings, pistons and other precision parts.

AC's *Aluvac* Element provides proved protection against these engine oil enemies. Its special accordion fold gives ten times the filtering area of ordinary elements, and its specially formulated filtering material screens out particles as fine as 1/100,000 of an inch.

Change your oil filter element at from 4000 to 6000 miles—and change to AC *Aluvac* to make your car's engine run better, longer.



AC SPARK PLUG DIVISION GM GENERAL MOTORS CORPORATION

Patients Enjoy This Hospital

[Continued from page 260]

after surgery, the patient is wheeled to a special recovery room, where he remains until he has gone through any of the first reactions to the operation and to the drugs used. A nurse stands by in the recovery room at all times.

Even the hospital's meal system is unique. In the modern basement kitchen, a new machine superheats glass dishes. These are popped by an asbestos-gloved attendant into a rubber-insulated metal shell, then carried on a conveyor past the cooks, who serve each plate while the dietitian supervises.

Patient Gets Food While It's Hot

At the end of the assembly line, a rubber-lined metal top is clamped onto the bottom shell, forming an insulated package, which is still steaming hot when it reaches the patient on one of the floors above. Food is served from a stainless-steel and glass cart, which carries huge vacuum containers of soup, coffee and boiling water.

All this medical high life costs no more than ordinary hospital care. The hospital itself cost $3,000,000 to build and has 224 available beds. This is considered a reasonable price in hospital circles. A semiprivate patient pays $15 a day, and $22 a day is the tab for a private room. The new father shells out only $140 for all hospital expenses during his wife's confinement.

Gone, in the Kaiser Hospital, are six a.m. awakenings for temperature-taking and meals. Breakfast is served at 8:30 after a leisurely awakening. Visitors are not viewed with distaste and suspicion, but encouraged. Visiting regulations are stretched and forgotten, if there's a good reason.

"After all," Nurse Brown summed it up, "we're here to help these people." END

Modern Movies

Son: "I got a movie report card this time, Dad."

Father: "What do you mean, a movie report card?"

Son: "Three D mentions."—*Pure Oil News.*

Copyrighted material

"Your best buy in power saws is MAXAW 700 with magic•pivot"

says Paul Jones, President, Cummins-Chicago Corp.

The Cummins MAXAW 700 I'm using makes that all-important 45° cut in 2 x 4's—with blade to spare. It makes every cut for every house. In fact, on a dollar-for-dollar and pound-for-pound comparison, the MAXAW 700 outperforms every saw in the 7" field. Yet it's so perfectly engineered that it weighs only 10 pounds—much lighter than other saws in the 7" field.

There in a nutshell is the amazing story of MAXAW 700 with *magic•pivot.*

The man who brought about the engineering miracle of MAXAW with *magic•pivot* is Fred Wappat, often referred to as the "power saw Edison." Mr. Wappat pioneered the portable power saw and was responsible for many of its early developments, one of the most notable being the telescopic guard.

But his greatest achievement—and the greatest made by any one individual in the power saw field—is the *magic•pivot* in Cummins MAXAW. Now, here is precisely what *magic•pivot* does:

Blades last twice as long

magic•pivot gives the saw blade of your MAXAW greater cutting depth at 45°, you get blade to spare. MAXAW blades will take three to four more sharpenings than blades of similar diameter used on other industrial saws. This means *magic•pivot* lets you use blades twice as long.

"Stub-radius" blades reduce friction, shock

magic•pivot permits MAXAW to use "stub-radius" blades to do the same cutting jobs as heavier saws with larger blades. With "stub-radius" blades there is less leverage re-acting on the saw mandrel shaft. Therefore, there is less shock transmitted to the gears, ball bearings and armature of the saw.

Puts more power at cutting edge

Power always diminishes as it reaches out from the saw shaft to the blade cutting edge. With *magic•pivot* which enables you to use "stub-radius" blades, distance from the power shaft to the cutting edge is shorter than with larger blades. Result—you get more power where you need it—at the cutting edge.

Less bulk—less weight handicap for user

magic•pivot reduces the handicap you place on a man on the job. A 1200-lb. race horse is handicapped with an average of 1 to 10 lbs. of lead. He works only a few minutes in each race. A man weighs from 150 to 200 lbs. He climbs ladders, roofs . . . is on the move 8 hours a day. He's handicapped on the job with anything but the lightest weight saw—the MAXAW 700 weighing only 10 pounds.

Mister, if you want a power saw that saves you time, money and energy, you want the MAXAW 700 with *magic•pivot.* It's perfectly balanced to stay on the cutting line, guides itself without pulling or wavering. This is the portable saw priced for the home handyman as well as the professional user. Imagine being able to get all this performance in an all ball and roller bearing 10-pound power saw—for only $69.50. That's right—only $69.50 buys you the finest power saw in the 7" field—the MAXAW 700. Ask for Cummins MAXAW 700 at your hardware or lumber dealer's. Don't settle for anything less. I'll be glad to send you our fully documented folder: "What *magic•pivot* Means To You." Every man who is interested in portable electric saws should read it. Please write me today.

Sincerely, Paul Jones
PRESIDENT

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***Makers of* MAXAWS, MAXDRILS, BALL•RITE and PERM-ALIGN DRILLS, FIXMASTER KITS, do-it SHOP**

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"Takes the work out of **Screwdriving"**

Every trade has its tricks. Here's one from an old time cabinetmaker. Pour a little Pol-mer-ik Linseed Oil in a shallow pan and soak your screws before you use them. They'll drive much easier and the linseed oil will seal the wood around the screws.

Archer
Pol-mer-ik
LINSEED OIL

A few of its 101 *Handy Uses:*

- Antique Refinishing
- Prevents sticking drawers
- Protecting Hand Tools
- Preserving paint brushes
- Glazing Windows

Archer Pol-mer-ik is the handiest single item in your home. One can of Pol-mer-ik will do the job of a dozen specialty products! Comes in handy pints or quarts, as well as in gallons and 5's. Better pick up a can today!

When You Paint

For years Archer Pol-mer-ik has been the choice of professional painters. A special heat treatment rearranges and locks the oil molecules together, gives you a tougher, more durable paint film. When you reduce paints with Pol-mer-ik they brush out easier, level better, have a smoother surface that collects less dirt, and give you a longer-lasting job!

FREE!

101 MONEY-SAVING IDEAS!

Get your copy today. Shortcuts and pointers from the "pro's" based on practical experience. Free! No obligation—just drop us a card. ARCHER-DANIELS-MIDLAND CO., 604 Roanoke Bldg., Minneapolis, Minn.

Sun Furnace Goes to Work

[*Continued from page 133*]

Experimental solar houses, heated mostly or entirely by the sun, show promise, and will look much more interesting if the necessary investment—still higher than for an ordinary heating plant—can be reduced. For heating homes and hot water, mirrors or lenses aren't needed. Temperatures up to 400 degrees F. can be obtained in flat-plate collectors, essentially glass-covered boxes lined with black-painted metal, through which water or air circulates to be heated.

Steam engines can be run on solar power, as Dr. Charles G. Abbot of the Smithsonian Institution has demonstrated in his pioneering experiments. So far, though, it's an expensive way—an Abbot boiler with a mirror large enough to produce two horsepower would probably cost about $1,000. Heat engines that could run efficiently at lower temperature than conventional types, dispensing with the mirrors' cost and complications, would be another story. That's something for inventors to work on.

Sunshine into Electricity?

A miniature "sun motor" exhibited not long ago by Charles F. Kettering, General Motors research ace, demonstrates the future possibility of turning sunshine right into electricity. Enough current to spin it is generated when a candle flame heats a tube bristling with twisted wires, or when a lamp's beam is directed on a bank of photovoltaic cells.

Twist together the ends of pieces of copper and silver wire, heat one of the two junctions, and current will be generated. This is the effect that a thermocouple applies to operate the temperature-indicating meter of an electrical pyrometer. Voltage and current can be multiplied to substantial figures, by connecting many thermocouples and heating one set of junctions. So it's easy, in imagination, to picture a solar power station where acres of thermocouples turn the sun's rays into free kilowatts. The catch is their notoriously low efficiency as en-

[*Continued on page 268*]

GET *Action* FOR YOUR MONEY!

Ten horses give you action for your money. *Ten* horses give you a margin of power that lifts your boat into a plane with certainty every time—*even with company along!*

Here is man-size power—in a compact, easy-to-handle unit that speeds or trolls with equal facility. High-torque performance, the result of extremely advanced design, means *terrific* acceleration all the way up! If you're going after extra power, get the kind that *counts*. Ask the happy owners of Sea-Horse 10's!

HIGHLIGHTS: Equipped with full-size fuel system for long-range operation (6-gallon Mile-Master). Fitted for remote control of throttle, shift and steering. Twist-Grip Speed Control. Full Gear Shift. Air Intake Silencers. New Up-and-Off Motor Hood for instant engine accessibility. Only $297.50 f.o.b. factory—outboard motoring's great buy!

Johnson SEA-HORSES FOR DEPENDABILITY

FREE! The complete new 1954 Sea-Horse catalog. Write for it. See your Johnson Dealer. Look for his name under "Outboard Motors" in your classified phone book.

JOHNSON MOTORS
500 Pershing Road, Waukegan, Illinois
In Canada: Mfd. by Johnson Motors, Peterborough

THE NEW 1954 SEA-HORSES

ELECTRIC STARTING SEA-HORSE 25—25 hp. The "automatic" outboard. Everything deluxe!.....**$498.00***

SEA-HORSE 25—25 hp. Speeds over 30 mph! Yet it trolls!.....**$410.00***

SEA-HORSE 10—10 hp. New. Improved. Outboarding's great buy.....**$297.50***

SEA-HORSE 5½—5½ hp. New. "Suspension Drive." It's *quiet!*....**$210.00***

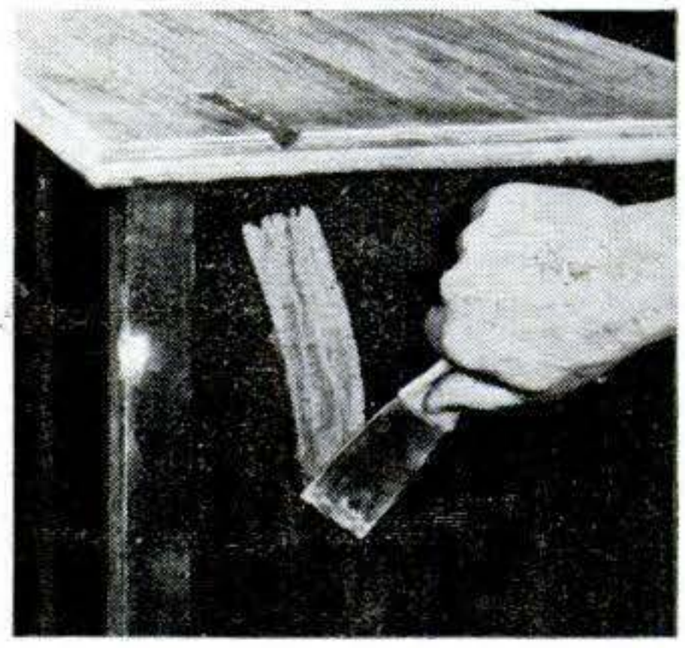
SEA-HORSE 3—3 hp. A 32-lb. *twin!* With Angle-matic Drive.....**$145.00***

SHIP-MASTER REMOTE CONTROL—Fits Sea-Horse 5½, "10" and both "25's." Instant hook-up. From.....**$29.50***

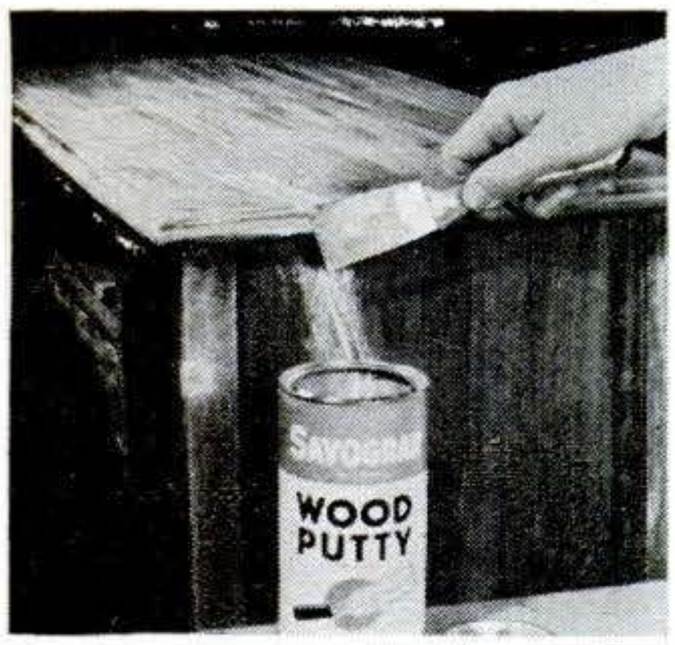
OBC

Prices f.o.b. factory, subject to change. OBC certified brake hp at 4000 rpm. Weights approx.

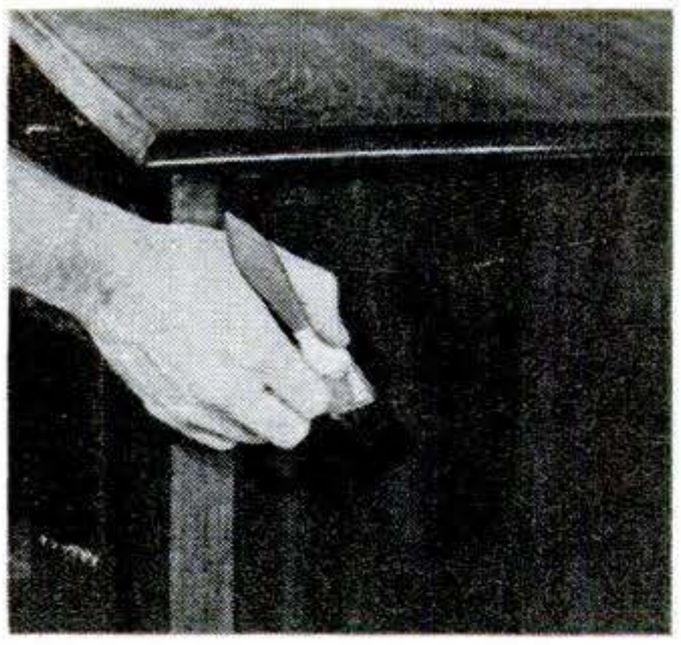
Hints on How to Refinish Furniture



Step 1. *Remove old finish*—quickly, easily, with fast-acting Strypeeze. Brush on, let it set . . . off comes the old finish. (hint: sprinkle sawdust over Strypeeze. "Roll off" sawdust, Strypeeze and old finish.)



Step 2. *Fill all holes, nicks* — permanently and simply with Savogran Wood Putty. Tools easily, won't shrink. Now, sand entire surface with 6/0 sandpaper. (For cracks in plaster, use Savogran Crack Filler. It's the original patented quick-hardening water putty.)



Step 3. *Refinish*—before you start, be sure brush is clean. Savogran Kwikeeze really cleans varnish brushes. Leaves no specks of old varnish, dirt in brush to mar finish. Apply stain, thinned shellac seal, then spar varnish or dull "rubbed effect" varnish in finishing.

SAVOGRAN

PRODUCTS . . . at better paint & hardware stores
Write for free helpful literature

SAVOGRAN CO., Dept. 44, 25 Huntington Ave., Boston 16, Mass.

Sun Furnace Goes to Work

[Continued from page 266]

ergy converters, although improved thermocouple alloys have lately raised the figure considerably.

Unlike photocells that merely control current from an external source, photovoltaic cells actually generate current, when light falls upon them. Camera fans' light meters employ photovoltaic cells. While a selenium or copper-oxide cell of this type may convert as much as 12 percent of light of some wave lengths into electricity, its low over-all efficiency compares with that of a thermocouple. Eventually the figure may be bettered but, as Dr. Harrison comments wryly, "Scientists must understand matter and energy much better before we can count on charging our automobile batteries from thermoelectric or photoelectric generators on the garage roof."

Improving on Nature's Way

There remains the chemical route to harnessing solar energy—tried and proved by nature, long before man came along to puzzle over the problem. All but five percent of the energy we use, including the coal we burn and the food we eat, has at some time been stored by photosynthesis in plants, which captured it from the sun. Can we do better than plant wheat, or corn, or sugar cane, on farms and plantations, and let nature take its course? Some think so.

It may have been a preview of the future when a crop consisting of 100 pounds of dried, microscopic plants was harvested at Cambridge, Mass., not long ago, for the Carnegie Institution of Washington.

The odd product consisted of myriads of single-celled algae of a kind called Chlorella. They had been grown in water containing suitable salts, circulating with carbon-dioxide gas in a plastic tube, while sunshine poured in through the tube's walls.

Experts predict an acre's yield of food could be multiplied manyfold by growing Chlorella in tanks, instead of planting

[Continued on page 270]

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SEE

New Moon

MOBILE APARTMENT HOMES

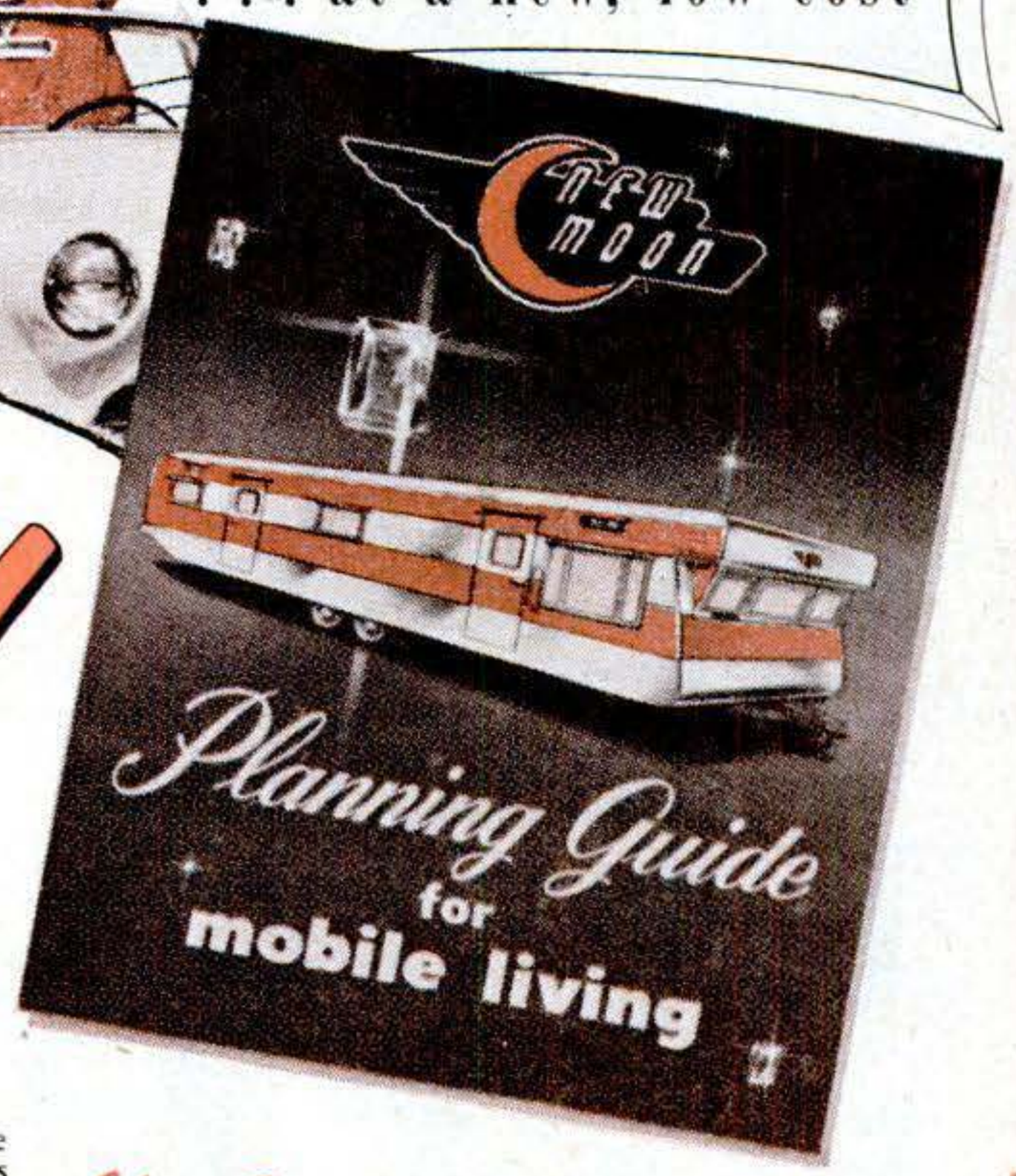
featured in M-G-M's Technicolor Hit "The Long, Long Trailer"

Starring **Lucille Ball** and **Desi Arnaz**

AT YOUR FAVORITE THEATRE SOON!

See PHILIP MORRIS' CBS TV SHOW "I Love Lucy"

Learn how you too can enjoy *Carefree Living* . . . at a new, low cost



GET YOUR

Free Copy

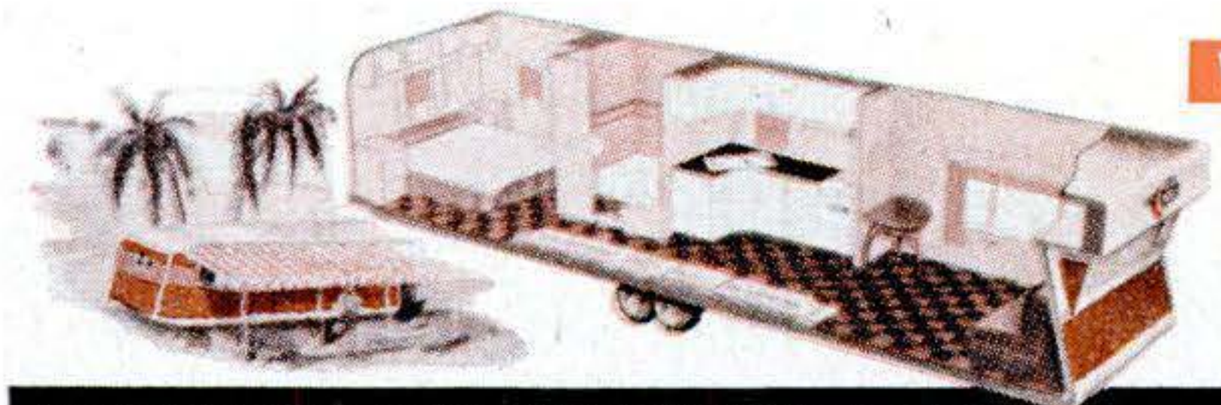
Read how thousands of folks are enjoying new economic security and living freedom in a completely furnished New Moon Mobile Apartment Home.

Newlyweds find New Moon Living the answer to facing an uncertain future with complete confidence. New low cost effects lower living expenses. Complete mobility permits moving to top paying jobs.

Men, whose work requires periodic moving, now take their families with them as they move from job to job. Their New Moon homes make it possible for them to enjoy real family life —and the kids love it too!

Servicemen find New Moon Living makes it possible to keep their loved ones with them, enjoy home comfort near-the-base as they move from camp to camp, and be all set for living after their discharge

Retired folks rave about New Moon Living as the answer to realizing life-long dreams. They travel, vacation, visit with their families, live North in the summer, South in the winter—in their New Moon Homes.



YOU TAKE YOUR HOME WITH YOU WHEREVER YOU GO • • • FOR SEMI-PERMANENT LIVING, TRAVEL AND VACATION FUN!

Your Passport to New Moon living!

Learn all about the advantages of New Moon mobile living—how you can enjoy complete living comfort and convenience in a New Moon mobile apartment home that is completely furnished and available in a variety of sizes to fit your living needs. This colorfully illustrated fact-packed book tells how you, like thousands of folks from all walks of life, can enjoy New Moon ownership at new low cost on our "like-rent" payment plan.

WRITE TODAY FOR YOUR FREE COPY

to: **NEW MOON HOMES INC.**
Alma 38, Michigan

WITHOUT OBLIGATION, please send me a free copy of "Planning Guide," describing the advantages of New Moon Mobile Apartment Living.

Name: _____

Address: _____

City: _____ State: _____

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POWER—when you want it

Hit hard, heavy blows. Or tap a rivet lightly. The Plumb Ball Pein Hammer puts out just the right amount of force for the job.

Here's how this controlled power is engineered in. Weight is centered below the eye, behind the striking face. This adds force to the blow. Yet this off-center design lets you hit easy, accurate blows with the cone shaped pein. You'll spread rivets evenly, never mash them.

The shock absorbing second-growth, hickory handle and the special analysis steel head give it quality and longer life.

But it is the scientific distribution of the weight that lets the Plumb Ball Pein Hammer—and not your arm—do the hard part of the job.

Quality Comes FIRST
PLUMB
is FIRST in Quality

PLUMB®

HAMMERS • HATCHETS • AXES • FILES

Sun Furnace Goes to Work

[Continued from page 268]

the soil at all. The dried or frozen product, we're assured, forms a nourishing paste with "a delicate grassy flavor." And if our palate isn't progressive enough to fancy such ultramodern fare, we can feed it to cattle or poultry, and be rewarded with old-fashioned steaks or fricassees in abundance.

Cerium Salts Get into the Act

Finally, the chemists are talking about bypassing biological processes entirely—and capturing sunshine right in flasks and test tubes! Sunlight is known to produce various chemical reactions, as when it turns blank film into a portrait of Aunt Ella. More promising for delivering useful quantities of energy is a photochemical reaction exhibited by salts of cerium dissolved in water, which Prof. Lawrence J. Heidt of MIT has been investigating.

The cerium salts' ions can take on two forms, called cerous and ceric. When sunlight acts on the solution, they change from one form to the other—and then back again. This might seem to get nobody anywhere. But, in the process, some of the water decomposes into elementary hydrogen and oxygen. The over-all result is that, with the cerium salts playing the role of catalyst, sunlight breaks down water into gases that can be burned for fuel.

We're still a long way from drawing the plans for a solar-powered gasworks. One percent would be a generous estimate of this reaction's efficiency in converting solar to chemical energy. But it's a break-through on a new front, one more promising approach for future experimenters to explore. END

Not Guilty

When a woman motorist was called upon to stop, she asked the motor cop indignantly, "What do you want with me?"

"You were going 60 miles an hour," accused the officer.

"Sixty miles an hour! Why I haven't been out an hour," she replied.—*Link-Belt News.*

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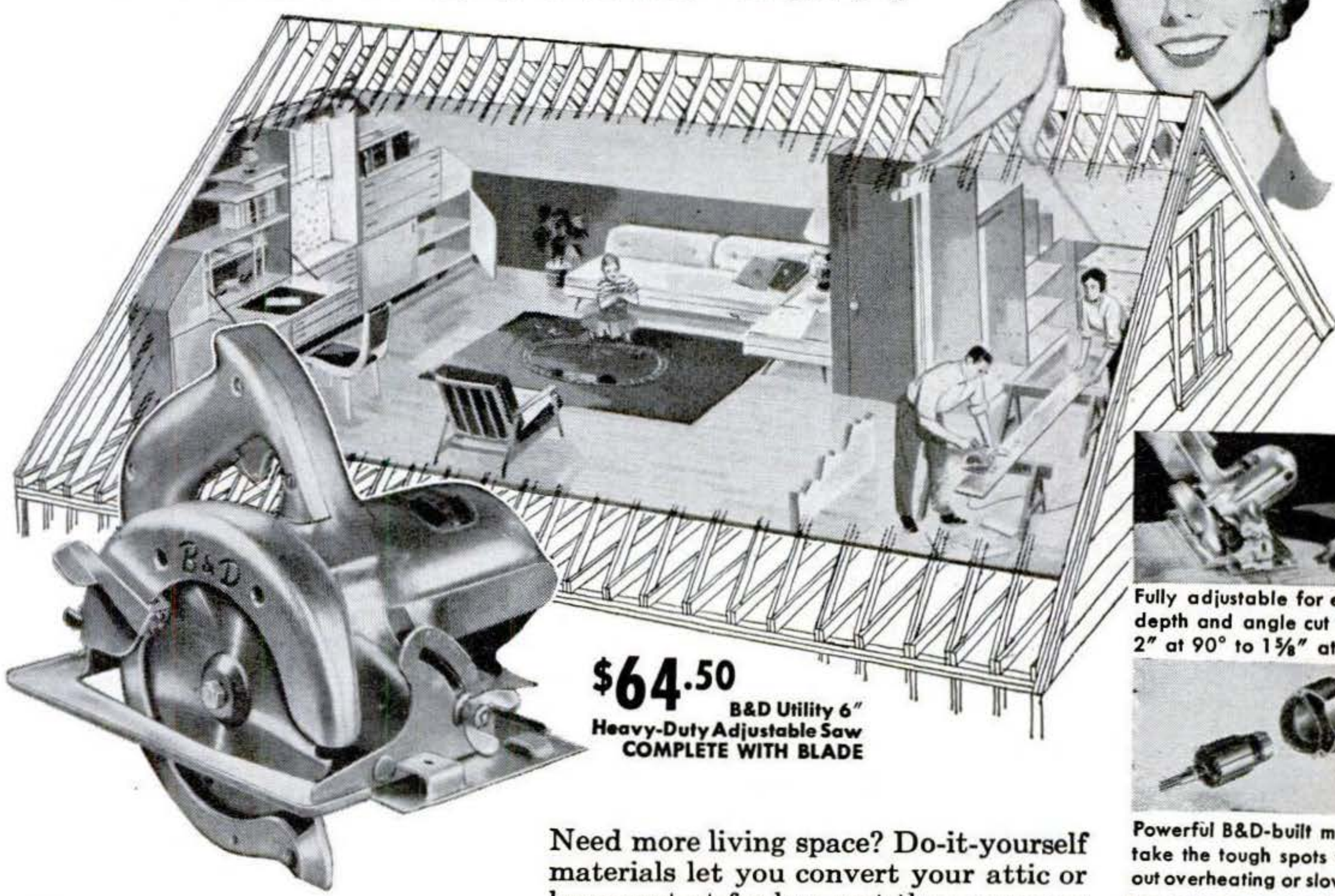
Look what you can do with this New Black & Decker Saw!



$64.50 B&D Utility 6″ Heavy-Duty Adjustable Saw COMPLETE WITH BLADE

Fully adjustable for every depth and angle cut from 2″ at 90° to 1⅝″ at 45°.

Powerful B&D-built motors take the tough spots without overheating or slowing.

New lever arm permits safe retraction of lower guard to make pocket cuts.

B&D saw-grip handle is always at natural sawing angle. Rugged, king-size shoe gives better balance.

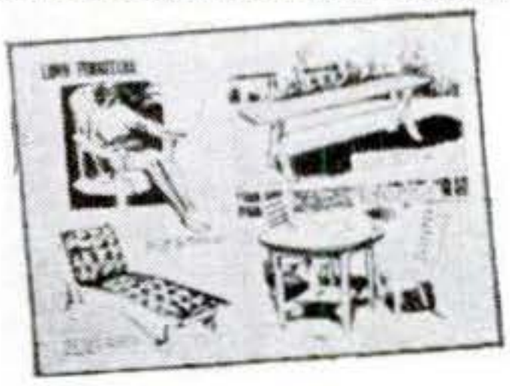
Try it yourself and get a chance to win $1,000.00

Get a demonstration of this wonderful new saw at your Utility dealer. Then fill out a free entry blank, describing the features you like best—and you may win $1000 in Black & Decker's big Saw Contest!

Bob Davis says:

Send 25c for my "Handy Tips" booklet, full of home repair ideas plus information on patterns for projects like sample below.* (No stamps, please).

*T. M. Reg. Easi-Bild Pattern Company



For address of your nearest dealer see "TOOLS - ELECTRIC" in the Yellow Pages of your telephone book.

Need more living space? Do-it-yourself materials let you convert your attic or basement at far less cost than you ever dreamed! And the new Black & Decker Utility 6″ Adjustable Saw takes the back-breaking work out of the job!

This new saw makes angle cuts, bevel cuts—every cut you need to add a beautiful room to your home, or make bookcases, cabinets, etc. You can get information on plans and patterns by mailing the coupon below, and your dealer will advise you on materials. When you visit him, ask to try the new Adjustable 6″ Saw—as well as the larger 7-, 8- and 9-inch Heavy-Duty Utility Saws!

Black & Decker

UTILITY® PORTABLE ELECTRIC TOOLS

Bob Davis, Home Service Dept. H3S, The Black & Decker Mfg. Co., Towson 4, Md.
Please send me "Handy Tips for Handy Men." I am enclosing 25c.

Name .....

Address .....

City ..... Zone ..... State .....

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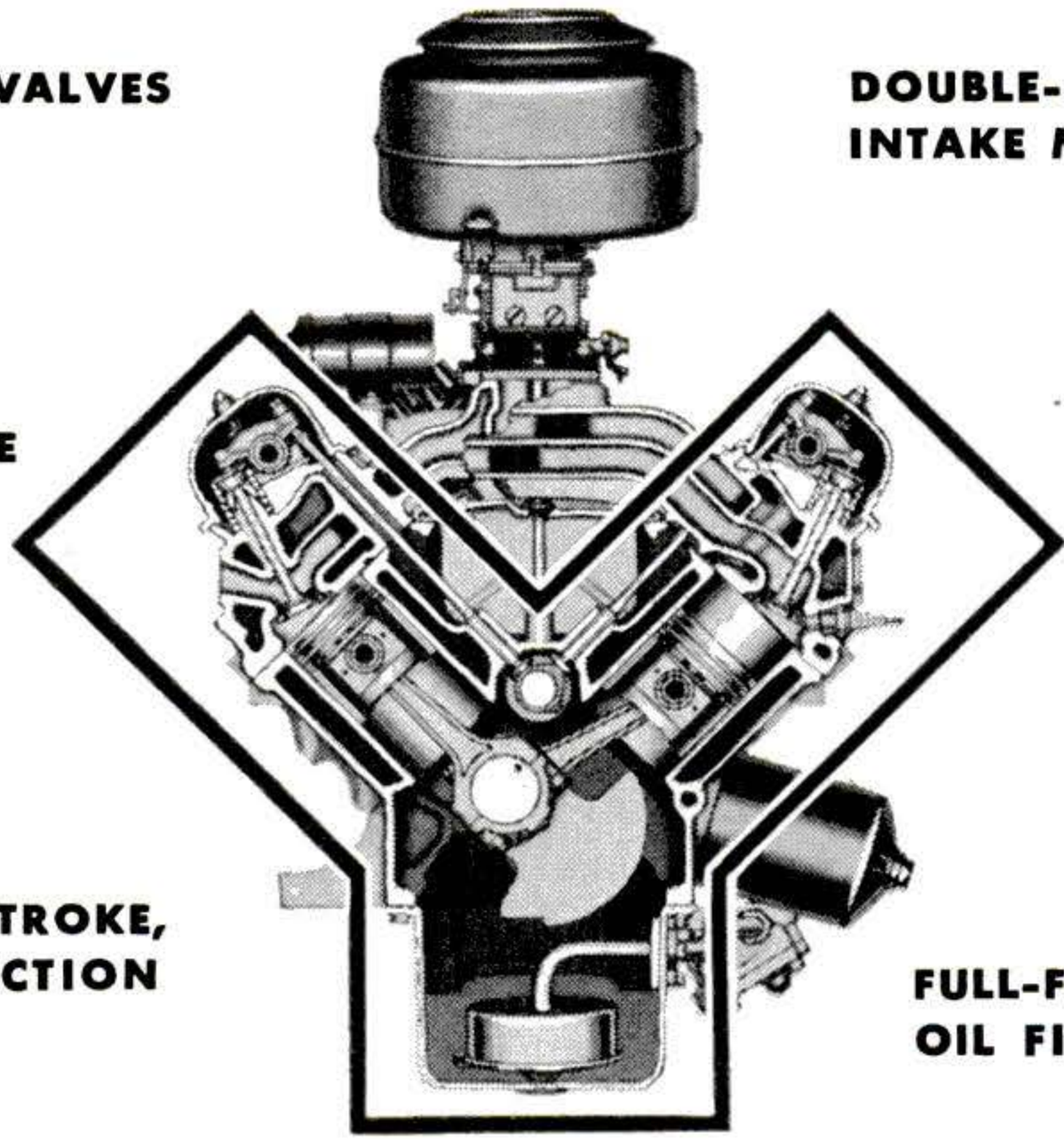

THE NEW 130-h.p. Y-block V-8

The story behind Ford's "Y" and "I"...

the two most modern engines in the industry

Twenty-two years ago Ford introduced the first V-8 in the low-price field. The basic design innovation then was the one-piece cylinder block . . . a design characteristic that has since been adopted by all other builders of V-8 engines. And now, with 22 years' experience building V-8's, it is only logical that Ford is first in its field to introduce a brand new type of V-8 . . . the Y-block V-8—along with the industry's most modern Six . . . the I-block Six.

Deep-block construction

Both engines have extra-deep blocks that extend well below the crankshafts, forming the "Y"- or "I"-shaped cross-sections. This results in far more rigid support for the crankshafts. Operation is far smoother and quieter, engine life far longer.

Free-turning overhead valves

Both engines have overhead valves that, in conjunction with their new intake manifolding, permit free flow of *full* fuel charges to *all* cylinders for more responsive performance. Valves are free-turning to help maintain their tight seal, keep compression high for continued top efficiency.

Try the "Y" and "I" at your

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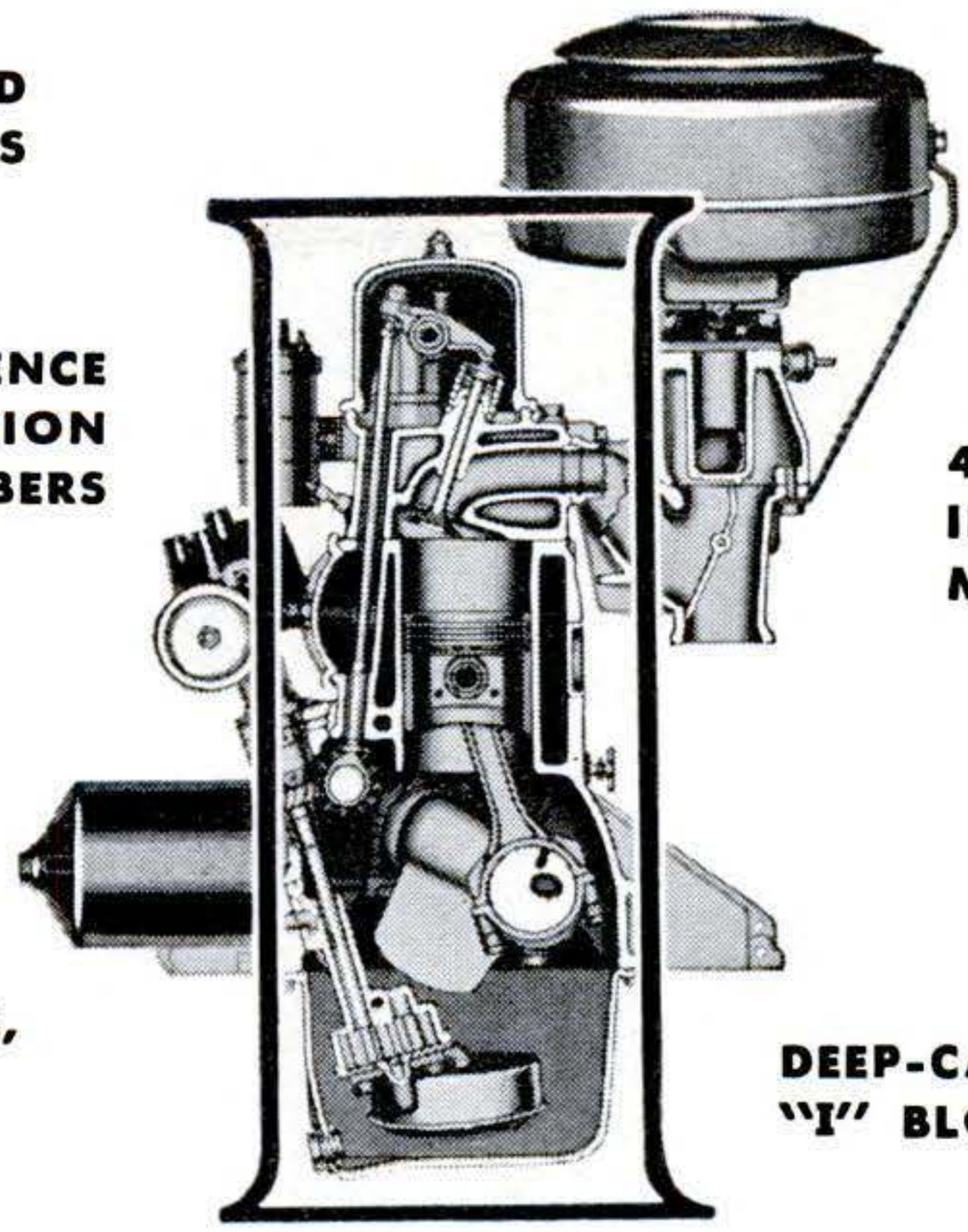

THE NEW 115-h.p. I-block SIX

Short-stroke, low-friction design

Both engines are "oversquare," that is, the bore is greater than the stroke. The short-stroke design means less internal friction, more usable power from every drop of gas.

Full-flow oil filter

A full-pressure lubrication system with full-flow oil filter forces completely filtered oil to all vital bearing surfaces and engine parts. Engine wear is reduced up to 66%. Base-mounting of oil filter eliminates external oil lines.

Choice of engines

Either the Y-block V-8 or I-block Six is available in any of Ford's 14 brilliant new body styles . . . and you may choose Ford-omatic Drive or Overdrive, if you wish. Stop in at your Ford Dealer's soon and Test Drive a '54 Ford with either of these great new power plants.

Ford Dealer's today!

'54 FORD

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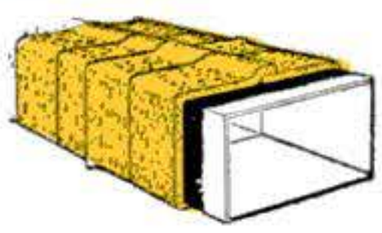
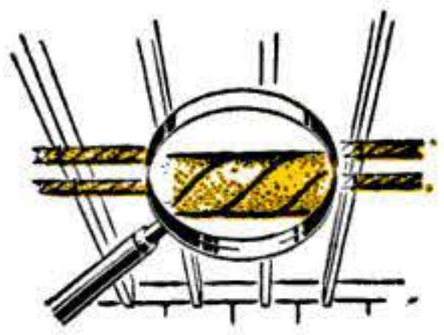
TIPS for the HANDYMAN

ON USING L·O·F SUPER-FINE FIBER-GLASS

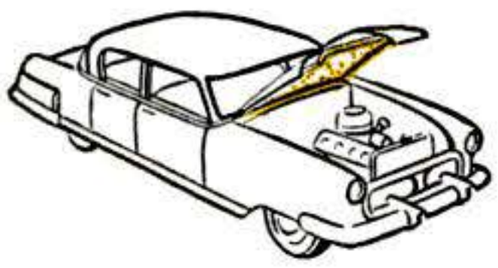
Here's a new insulating product of "1001 uses." Wonderfully easy to handle and apply. And so versatile, so effective, you'll find uses for it in a dozen places 'round the house.



Save fuel by wrapping fire-resistant Super·Fine around your heating ducts! Highly efficient *heat* insulation. Flexible, lightweight, easy to install.

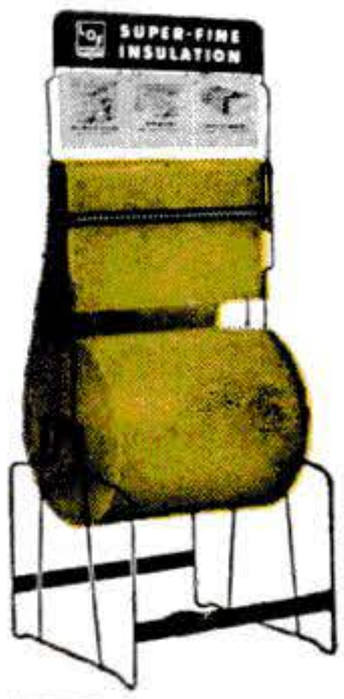


Reduce dripping from *cold* water pipes. Reduce heat loss from *hot* water pipes. Spiral wrap them with Super·Fine. Will not mildew or rot.



L·O·F Super·Fine installed under the hood of your car reduces airborne noise, tire whine and air-stream whistle.

Sound-insulate your home workshop! L·O·F Super·Fine provides excellent *sound* absorption. Cuts easily with scissors or knife.



Get L·O·F Super·Fine at your favorite hardware dealer's, where this rack is on display. If your dealer doesn't have it, write Libbey·Owens·Ford, Fiber-Glass Division, 4934 Wayne Building, Toledo 3, Ohio.

L·O·F GLASS Corrulux FIBER-GLASS

FIBER·GLASS

Needle to Stop Deadly G-Gas

[Continued from page 146]

looked at Kathleen and she nodded. This was something we had to do."

The profit-minded Hirsch kept Potter busy filling orders for flow meters. When several weeks passed without progress on the injector, the Conscience, Miss Ruch, caught Potter's attention. She reminded him that he had been postponing month after month some minor, but necessary, surgery. If Dr. Sarnoff arranged for the operation at Harvard's hospital, couldn't Potter work on the injector while he convalesced? He could.

Simultaneous Operations

That was how the injector came to be designed by an aeronautical expert in a hospital. Potter was operated on one day, rested the next, then started sketching in bed. Sketches and experimental models were shuttled back and forth between the Boston hospital and the Newark plant. When Potter was discharged from the hospital a week later, the automatic hypodermic needle existed in pretty much its finished form.

"Hirsch was right about our losing money," Potter says. "I figure the job has cost us $50,000 so far."

Potter frankly admits, however, that he stands to recoup this and much more. He made 1,500 injectors on a pilot contract for Army field trials, and has similar orders from the English and Canadian governments. Wartime demand would be astronomical—one injector for every man, woman and child. Peacetime prospects appear profitable, too. A reliable automatic injector would be handy for diabetics, who must give themselves regular shots of insulin. And doctors and dentists, too, might find it useful when treating patients who quake at the sight of a needle. END

Telling the Truth

WHEN the lady who was making out a job application came to the little square headed "Age," she didn't hesitate. She simply wrote: "Atomic."—*Phoenix Flame.*

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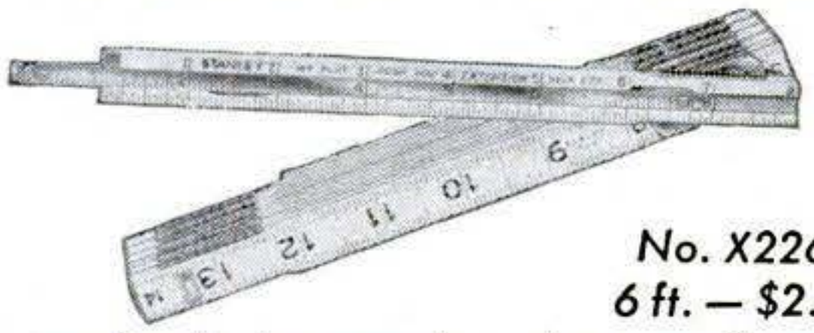
You don't have to be a carpenter to want, yes, even to need — fine tools. Put a Stanley tool in your hands. Use it. You'll feel the difference. For everyone from schoolboy to professional *Stanley is the toolbox of the world.*

Tool UP With Stanley Take this "100 PLUS", for example. Sure, you can drive a nail with almost any hammer — one way or another. But your hands will tell you *this* one. It hits the nail hard, and drives it straight and deep. You'll get a smacking sense of satisfaction every time you use it.

"100 PLUS"
*No. 11½ — $3.50**

***Western prices slightly higher.**

Measure UP With Stanley

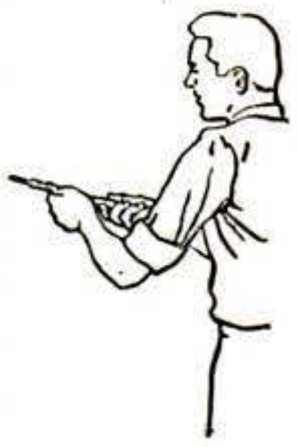


No. X226 —
6 ft. — $2.75

A good rule is a must, and a new favorite is this Stanley '100 PLUS'. It's a good friend, many times tested and all ways true. The joints lock firmly, the square ends stay square, the handy 8-inch brass slide slides but never slips, the easy-to-read numbers are always easy to read. For *more* than a measure of satisfaction, say Stanley the next time you buy a rule.

Tool UP With "YANKEE"®

No. 41 — $5.65



The "Yankee" push drill is a quick, one-hand worker . . . the ideal tool for boring screw holes. The drill point spirals in easily and the built-in spring returns the handle for the next stroke. You're through in no time. What's more, the magazine handle holds 8 drill points from 1/16 to 11/64 inch — the size is always right.

THE TOOL BOX OF THE WORLD

STANLEY® Tools

ELECTRIC TOOLS • HARDWARE • STEEL STRAPPING • STEEL

How Long Is Your Square Tongue?

Sure that's a silly question. But if you haven't a steel square you'll never know.* On the other hand, with one of these Stanley rafter squares you can really get on top of things — build a roof, for instance, on your new porch or garage. Send for your free copy of "Rafter and Framing Squares". You'll learn all about roof framing, common rafters, hip and valley rafters, brace measures, etc. Use the coupon.

***The Stanley rafter square tongue is 16" long.**

STANLEY TOOLS, 434 Elm Street, New Britain, Conn. or
STANLEY TOOL CO. of CANADA, 434 Stanley St., Roxton Pond, Que.

☐ Please send me STANLEY TOOL GUIDE for which I enclose 25¢.
☐ Please send me FREE "Rafter and Framing Squares" — S51.
☐ Please send me FREE "YANKEE" Tool Book Y41.

*Name*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

Copyrighted material

New Gadget Dispenses "Instant" Shave Lather!

Now science declares "push-button" war on whiskers! Here's shaving lather right out of a can . . . the richest, creamiest lather you ever saw. Ready instantly!

No brush to slow you down . . . no greasy cream to clog your razor. Just push valve and out comes lather! That's AERO SHAVE . . . greatest shaving invention in 50 years. AERO SHAVE wilts toughest whiskers fast, thanks to 3 wonderful beard-softeners. It also contains soothing Lanolin for extra skin comfort, freedom from shaving irritation.

Enjoy quicker, slicker shaves every day with AERO SHAVE lather bomb . . . only 59¢.

Not ~~89¢~~...Not ~~69¢~~ only 59¢

Use "Push-Button" Lather

AERO SHAVE

Also economical King Size—12 oz. only 98¢

MACHINISTS... Get this *Free* "New Tools" Catalog

NEW LUFKIN PRECISION TOOLS Can Make Your Job Easier!

New Lufkin dial indicators, wigglers, radius gages, trammels, machinist levels and Miti-Mite magnetic base tools combine the latest design features with years of experience to give you accuracy, durability and speed.

255 *Mail the coupon today for illustrated catalog*

BUY LUFKIN TOOLS AT YOUR HARDWARE OR TOOL STORE

MAIL TODAY

LUFKIN RULE CO., Saginaw, Mich., Dept. PS
Please send me your *FREE* "NEW TOOL" Booklet

Name_____

Street_____

City_____ State_____

Magnetic Clutch

[*Continued from page 151*]

a fast power shift from low to second. Then quickly the two clutches traded places again and away you went in second. In effect, the engine is "held against" high for the fraction of a second needed for a shift. This has the double virtue of holding down revs in the momentarily unloaded engine and of minimizing torque discontinuity.

The events are rather as though the transmission said to the engine, as time for the shift neared, "Look, chum, you'll have to lay off those gears while I slide them around a bit. It won't take long, but just so you don't go revving up, I'd be obliged if you'd work on high gear for a moment. I know you aren't ready for high just yet, but if you'll do it anyhow, I'll be right back with a dandy new ratio."

Laddering. Since the clutches can be pulsed to produce this high-speed turnabout, there's no need for a break in the power flow for shifting. It's done in a torque path that is temporarily off duty.

Eaton has a four-speed transmission that shows this. You start in low via one clutch. Pretty soon this trades with a second clutch that's ready with second gear. Then the first clutch pairs up with third gear, and while it's working, the second clutch gets set with fourth gear. Company engineers describe this as "laddering," meaning the transmission does what you do when you climb a ladder with each foot touching alternate rungs.

This is much smoother, of course, than the half-step procedure when each foot rests on each rung. In a car, with smooth clutches to bridge the change-overs, it gives performance almost indistinguishable from the oiliest hydraulic job.

When can you buy one? Eaton doesn't know, but thinks maybe in a year or two. The company, which is highly respected in Detroit as a maker of valves, pumps, springs, heaters and truck axles, has already shipped prototype clutches to the automakers for testing. There seems to be little likelihood that the

[*Continued on page 278*]

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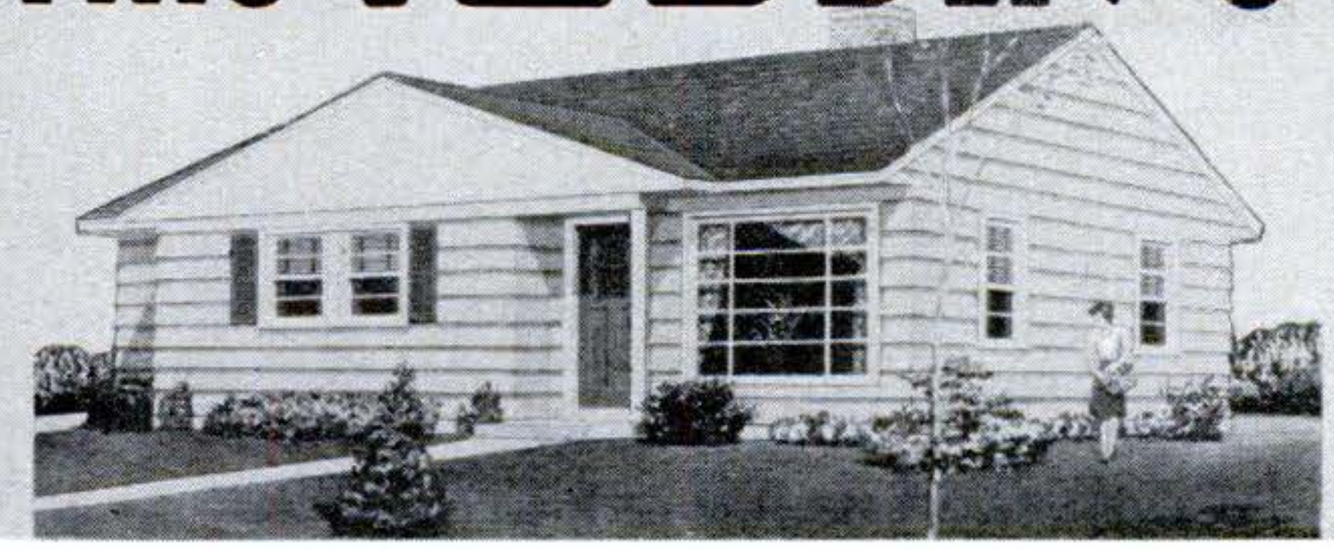
THIS ALADDIN 5-ROOM HOUSE



$1995

FREIGHT PAID

Slightly Higher West of Missouri River

YOU CAN BUILD THIS ALADDIN READI-CUT HOUSE YOURSELF... and Save Hundreds of Dollars!

Imagine receiving A COMPLETE HOUSE IN ONE SHIPMENT—ready to erect! You get everything needed. The lumber is the finest—every piece THOROUGHLY DRY. And it comes to you the EXACT SIZE needed—cut at the mill by fast, precision machines. No stopping to measure and saw each piece! (You save as much as 30% on labor—18% on waste) and YOU CAN CHOOSE FROM 99 INDIVIDUAL PLANS—beautiful, modern houses of all sizes and styles. Not only will you save money but you will have the satisfaction of knowing that Aladdin Houses have withstood the test of time during the past 48 years. Aladdin's thousands of satisfied customers are your guarantee of honest value. We will send you names and addresses on request.

BEAT THE HIGH COST OF BUILDING!

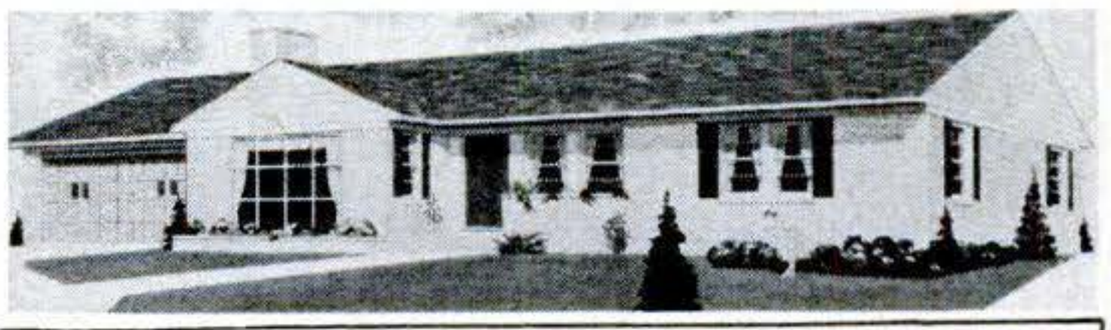
BUILD YOUR OWN HOME

With carpenters getting up to $24 a day think how much you can save by building your own Aladdin house! Carpentry work runs from 300 to 1200 hours. Even if you hire help you save because most of the expensive, time-consuming labor (measuring and cutting) has been done at the mill. No wonder the cost of an Aladdin house often compares favorably WITH PRE-WAR COSTS! Drawings and instructions are easy to follow and cover everything from foundation up. More than half the Aladdin houses sold have been erected by buyers themselves!

NO DEALERS' OR AGENTS' PROFITS IN ALADDIN PRICES—*BUY DIRECT!*

GOOD HOUSES NEVER GROW OLD—

ALADDIN HOUSES ARE NOT PREFABRICATED

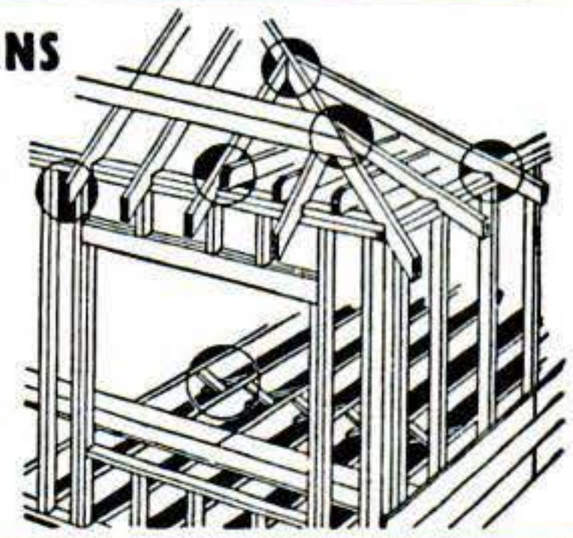


QUALITY: ALL EXPOSED LUMBER IS GUARANTEED TO BE CLEAR AND **KNOTLESS**

WHAT READI-CUT MEANS

The picture at the right shows how each piece of Aladdin lumber is cut to EXACT size at the mill—mitred and bevelled for perfect fit. Aladdin houses are designed to meet the most exacting building standards in both construction and materials.

IMMEDIATE DELIVERY



WHAT YOU GET WHEN YOU BUY AN ALADDIN HOUSE

- ALL THE LUMBER accurately cut to fit, marked and numbered ready to erect practically without the use of a saw.
- SIDING
- WINDOWS
- MOULDINGS
- GLASS
- MILLWORK
- DOORS
- HARDWARE
- NAILS
- FLOORING
- TRIM
- PAINT
- ROOFING
- COMPLETE DRAWINGS & INSTRUCTIONS

EXCITING NEW HOME DESIGNS FOR 1954!

ALADDIN GUARANTEE SATISFACTION OR YOUR MONEY BACK

SEE THEM IN THE LATEST BOOK OF ALADDIN HOMES →

Send 25¢ FOR BEAUTIFUL NEW FULL-COLOR 64 PAGE CATALOG **No. AM-19**

THE ALADDIN CO.

BAY CITY, MICHIGAN

Est. 48 Years

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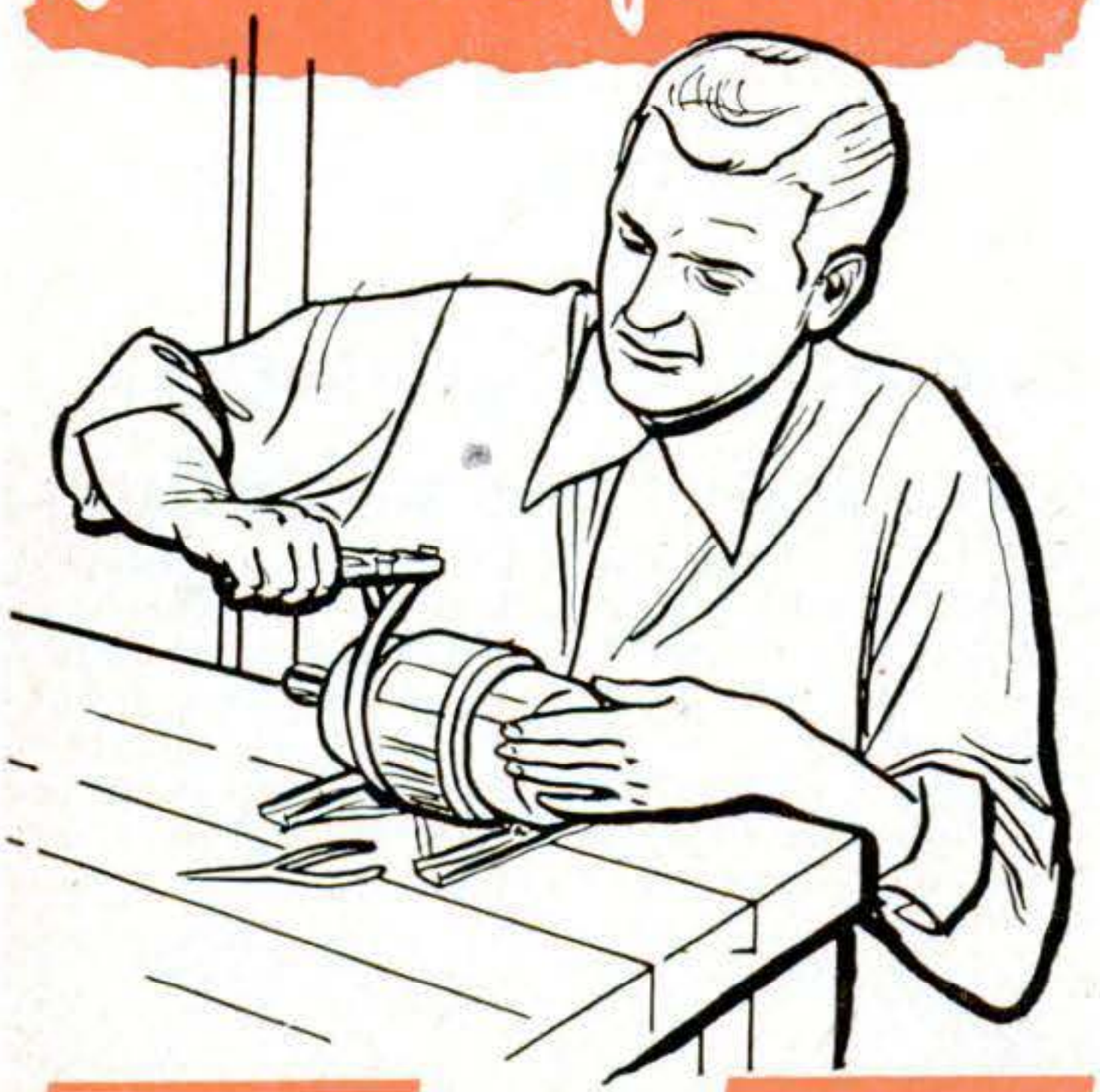
From the start of the job to the finish...



CHANNELLOCK
TRADE MARK REG. U. S. PATENT OFFICE

pliers are busy

here's why

Look for the Channellock line when you're shopping for hand tools. Channellock pliers offer features that you can't get with other makes. And when you buy a Channellock plier, ask to see the full line — you'll find a style and model to do any job better.

THE PLIER DESIGN THAT OBSOLETES ALL OTHERS

CHAMPION DeARMENT TOOL CO. • MEADVILLE, PA.

Magnetic Clutch

[Continued from page 276]

clutch will be sold for installation on existing cars; it wants to be put in at time of manufacture.

Present estimates are that the "poor man's automatic"—the one-clutch semi-automatic job—will be used on trucks and taxis in this country, and on passenger cars abroad. (High fuel costs overseas have held back acceptance of gas-hungry hydraulic transmissions.) In this country, Eaton thinks that three- and four-speed full automatics will be preferred. It believes that they will cost less to make and run than hydraulic jobs, and will give better performance.

Magnetic-powder clutches in small sizes are due to appear in 1954 on the compressor drives of auto air conditioners, and on the hubs of engine fans. The fan application is attractive: an ordinary radiator fan can eat up three or four horsepower at high speed, and contribute a big share of total engine noise—all for cooling that's needed only a small part of the time. On a car fan, a magnetic clutch would be automatically switched by a thermostat.

Any bugs? Apparently not. Eaton won't quite claim that the magnetic powder will never wear out—though they do say they haven't been able to wear any out in years of trying. The clutch will withstand an incredible amount of slipping.

If the magnetic-powder clutch is as good as it looks, it will give those intricate, gas-greedy hydraulic boxes a whale of a run for your money. END

Ground Speed, Too

AN OLD gentleman was riding in an airliner for the first time. At Phoenix, Ariz., the plane made a beautiful landing, and immediately a red truck rushed alongside to refuel it. The next stop was Fort Worth, and again a red truck came up. The same thing occurred at Nashville.

A fellow passenger said to the gentleman, "These planes certainly make wonderful time."

The old man replied, "Yep. And that red truck ain't doing so bad, either."—*Fireman's Fund Record.*

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BRAND NEW!

RUGGED!! MASSIVE!!

*25 TON

CAPACITY

HYDRAULIC CYLINDER

• ALL STEEL CONSTRUCTION • 8" BORE — 15" STROKE • DOUBLE ACTION

ITEM #1815

• 50,000 LBS. PRESSURE WITH 1000 P.S.I. PUMP OUTPUT • UP TO 70,000 LBS.—CAPACITY ON INTERMITTENT SERVICE • SOLID STEEL 2½" PISTON ROD • 1" PORTS • OVERALL DIAMETER—10½" • DISTANCE BETWEEN CENTERS—28¼" CLOSED—43¼" OPEN.

IDEAL FOR

- ★ HYDRAULIC PRESSES.
- ★ DUMP TRUCK HOISTS.
- ★ TD-18, TD-24 INTERNATIONAL HARVESTER DOZERS AND GRADERS.
- ★ LEVELING RAMPS.
- ★ INDUSTRIAL MACHINERY.
- ★ ROAD MACHINERY.
- ★ FARM MACHINERY.
- ★ HYDRAULIC TAIL GATES.

Replacement cost—$300.00. Shipping Wt.—185 lbs.

SPECIAL PRICE **95.00** F.O.B. CHICAGO

ITEM #1715

• 7¼" BORE—15¼" STROKE
• 41,300 LBS. PRESSURE WITH 1000 P.S.I. PUMP OUTPUT
• OTHER FEATURES SAME AS ABOVE

Replacement cost $260.00. Shipping Wt.—155 lbs.

SPECIAL PRICE **80.00** F.O.B. CHICAGO

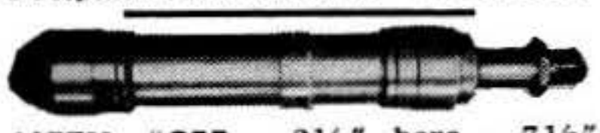
BRAND NEW DOUBLE ACTION

HYDRAULIC CYLINDERS

NEW MANUFACTURE

ITEM #224—3¼" bore, 24" stroke, will lift 8250 lbs. with 1000 P.S.I. line pressure. ½" pipe thread ports—1⅜" stress-proof ground, polished & plated solid steel shaft. Overall length closed 36". Ship. Wt. 50 lbs. F.O.B. Chicago... **39.60**

***ITEM #16-C**—1½" bore, 26" stroke. Will lift 1760 lbs. with 1000 lbs. pump pressure. Great for hay loaders, etc. 1" stainless steel piston rod. Postpaid..... **16.95**



***ITEM #355** — 2½" bore — 7½" stroke. Mfgd. by Delco-Remy. Clevis mounting. ⅜" pipe thread ports. F.O.B. Chicago..... **16.00**

BRAND NEW! JUST RELEASED!

BLACKHAWK HAND-HYDRAULIC PUMP

✻ **ITEM #82.** Perfect for Hydraulic Presses, Snow Plows, Farm Wagons, Jacks, and Farm Plows.

A few easy strokes of the 20" handle and you can lift 5000 lbs., using Item 355—Hydraulic Cylinder. Blackhawk Model P-151—complete with built-in oil tank and release valve.

Rated 1200-8400 lbs. per square inch. Dim. 9"x7"x6". Ship. wt. 35 lbs. Worth much more. F.O.B. Chicago..... **22.50**

FREE SPRING-SUMMER EDITION

1954 CATALOG, 52 PAGES, chuck-full of unsurpassed War Surplus Equipment Bargains for farm, home, factory and workshop. Write today. Most advertised items just released, not yet in catalog.

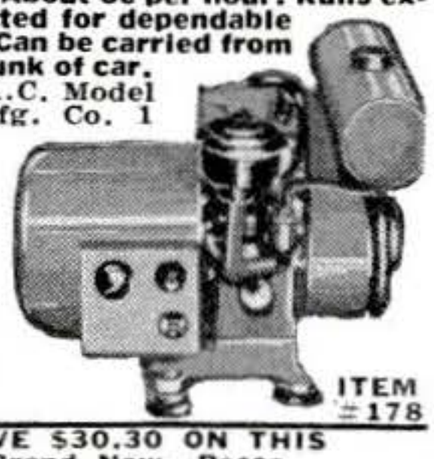
BRAND NEW WAR SURPLUS.

* RELEASED SINCE KOREAN TRUCE

NOW . . . SAVE $161.00 on this $250.00 VALUE

350 WATT A.C. PORTABLE ELECTRIC LIGHT PLANT

*Compact Electric Plant suited for small homes, cabins, campers, hunting and fishing camps, trailers and small electrical home appliances. Operating costs: About 5c per hour. Runs exceedingly quiet. Sturdily constructed for dependable service. Net weight only 88 lbs. Can be carried from place to place, or transported in trunk of car.



350 Watt—110 Volt—60 Cycle—A.C. Model—M.S. 35-3, made by Midco Mfg. Co. 1 Cylinder, 4 Cycle Engine complete with muffler, starting rope and oil bath air cleaner, direct coupled to a 350 Watt Generator with voltage control rheostat and twin outlets. Engine speed 1800 R.P.M. Shipping weight 116 lbs. Commercial List Price $250.00 NOW ONLY **89.00** F.O.B. Chicago

ITEM #178

ITEM #371V

SAVE $30.30 ON THIS

Brand New—Pesco

HYDRAULIC CONTROL VALVE

NEW MANUFACTURE

FOR SAFE, POSITIVE CONTROL OF HYDRAULIC CYLINDERS AND MOTORS—• BUILT-IN RELIEF VALVE—factory set at 1200 P.S.I. • FOUR-WAY VALVE—to operate one double acting cylinder • OPEN CENTER—with valve in neutral, cylinder is locked in position and pump is unloaded. • SPRING RETURN TO NEUTRAL • FULLY BALANCED PLUNGER • EASILY STACKED INTO 2, 3, or 4 valve combinations for multiple cylinder operation. • 8 gal. per min. capacity, at 1500 P.S.I.,—⅜" pipe ports. • CONNECT PUSH RODS TO HANDLE FOR REMOTE CONTROL. • EASY MOUNTING • LIST PRICE—$46.80. • YOU SAVE $30.30. • DIMENSIONS—9"x4½"x2½"—Ship. Wt.—8 lbs..... **16.50** F.O.B. Chicago

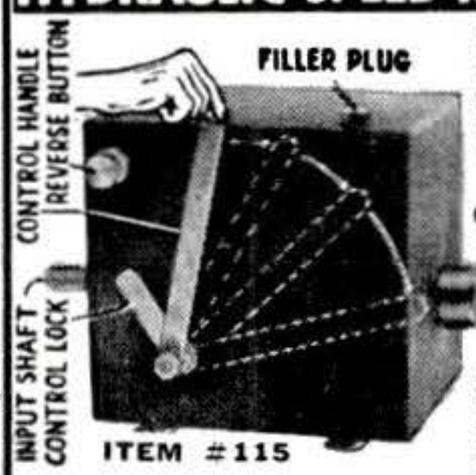
*GOV'T SURPLUS! JUST RELEASED!

2-TON, 6-WHEEL HYDRAULIC LIFT TRAILERS

USE FOR: Conveyor ramp • Boat trailer • Lumber • Pipe • Pole trailer • Machinery trailer • Hydraulic dump for grain wagon • Coal truck • Lift truck • Variable height hydraulic work table • Removable rack permits use of hydraulic lift for other installations. Outstanding features of these trailers are:—4000 lbs. pay load. 2 individual hydraulic lifts complete with hand pumps and valves. 6—18"x5.5 pneumatic tires included. Manual screw-down brakes. Ball-bearing axles. V-shape load rack—8' long. Towing tongue. 54" lift. Wheelbase 98". Ground clearance 4½". Tread width — 52". Overall width — 58". Overall length including drawbar—167". Gov't. cost $685. Ship. wt. 1400 lbs. F.O.B. Chicago **169.50**

Item #356

HYDRAULIC SPEED REDUCER with FINGERTIP CONTROL*



ITEM #115

USE FOR: • Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps

Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of ¼ to 1½ H.P. This Westinghouse-Oil Gear Unit consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Shafts measure ⅝" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speed not to exceed 750 R.P.M. Over-all dimensions, 7½"x7½"x11½". Gov't. acquisition cost $428.00. Shpg. wt. 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago..... **54.50**

ITEM #G-75

*A.C. ELECTRIC GENERATOR

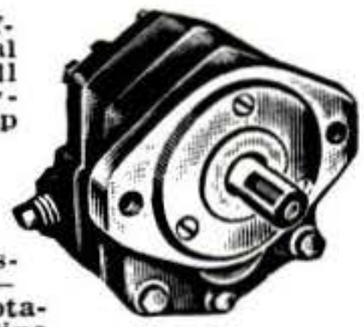
ITEM #G-75—7500 Watts, 120 Volt, 60 Cycle, 1800 R.P.M. single and three phase current, for 2 or 3 wire circuits electric generator, double ball-bearing construction, standard 1¼" shaft with keyway, and included at no extra price, 5-groove six inch pulley for belt drive. Direct connected Self-Exciter Foot Mounted. Gov't Acquisition cost: $545.00. Dim. 34"x11½". Ship. wt. 250 lbs. Price Slashed To:..... **269.00** F.O.B. Chicago

BRAND NEW—MULTI PURPOSE

HYDRAULIC PUMP OR MOTOR

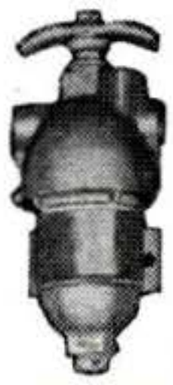
NEW MANUFACTURE

ITEM #55



Silent, High efficiency, Helical Gear Type Ball Bearing, Hydraulic Pump or Motor. Rated 8 Gal. Per Min. At 1500 R.P.M. —Delivers—1000 P.S.I. Using 6 H.P.—Reversible Rotation — ¾" Pipe Thread Inlet and Outlet Ports—¼" Drain Port—¾" shaft with keyway and flat for either direct or pulley drive. Dimensions—5⅜" high, 7¼" long, 5⅛" wide. Shipping weight 18 lbs. F.O.B. Chicago..... **45.50**

PUROLATOR OIL FILTER

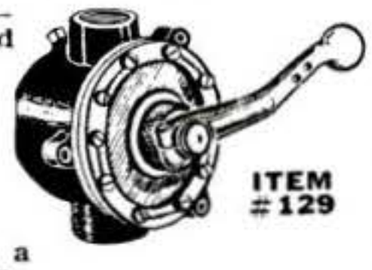


***ITEM #70**—A perfect permanent element oil filter to keep your motor oil or hydraulic fluid clean at all times. Protect your pump or engine with this unit. Just turn the handle and the element is clean. Standard ⅜" inlet and outlet ports accommodate 16 gallons per minute. Shipping weight 4 lbs. $13.00 value. NOW ONLY..... **5.95** Postpaid

SELF-PRIMING

HAND FLUID PUMP

WITH STRAINER



ITEM #129

*Type D-2 — Bronze and aluminum construction. ½" pipe thread ports. Fine general utility hand pump. May be used as a sump pump, barrel pump, fuel transfer pump, for water, oil, gasoline, insecticides, etc. Capacity—200 Gal. per hour. Ship. wt. 6 lbs..... **11.95** F.O.B. Chicago

ROSS 4-WAY FOOT OPERATED

AIR VALVE

ITEM #60

BRAND NEW—For double-acting pneumatic devices. Fine for operating presses, air vises, air machinery of many types. Heavy duty cast construction. No neutral position. Maintains pressure against the piston when the foot control is in the "Up" position. Threaded for ½" pipe. Dimensions of valve body: 7¾" long x 4¼" width x 7½" high. Net weight 28 lbs. A $64.00 value for only **19.50** F.O.B. Chicago

D. C. GENERATORS

ITEM #91

*Type R-1, rated 300 Amps. — 30 Volts. Mfd. by Jack & Heintz. Government Acquisition Cost$380.00. Shpg. wt. 55 lbs. Dimensions 16"x10"x7". F.O.B. Chicago **35.00**

***ITEM #90**—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost $300.00. Shpg. wt. 55 lbs. Dimensions 15"x9"x6". F.O.B. Chicago..... **22.50**

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WEEK-END DECORATORS!

PAINT TRAP

Reconditions old hard brushes
Thoroughly cleans after using

• Place brush in can of PAINT TRAP and work back and forth on the "Stay-Clean" Paint Trap. Emulsifying action washes away any paint, varnish or shellac. Old paint settles in paint trap—liquid can be used over and over. It's safe for all bristles. No fire hazard. Buy PAINT TRAP Brush Cleaner where you buy paint, or write:

The Klean-Strip Co., Inc.
2340 S. Lauderdale, Memphis 6, Tenn.

The new Evans "White-Tape" has everything you'll find in tapes costing over $1.50—plus.

- snow-white blade with bold, legible, jet-black numerals and graduations. Graduated in 32nds for first 6 inches.
- sturdy die-cast case heavily chrome-plated, calibrated for quick reading inside and outside measurements.
- blade ½" wide made of finest high carbon steel—tempered—Bonderized—enamelled—baked.
- blade replaceable in seconds—without tools—without even opening case. And Evans replacement blades cost far less.
- every Evans "White-Tape" is unconditionally guaranteed.
- exclusive Evans automatic brake gives smoother push-pull action with absolutely no "creeping" of tape into case.
- underside is white, too. Mark with ordinary pencil, remove mark with flick of thumb.
- unheard-of low price*: 10-ft. $1.49; 8-ft. $1.19; 6-ft. 98¢. Prices higher in far west and Canada.

Evans & CO *Sold only through retailers.* Elizabeth, N. J., Montreal, Que.

Makers of Evans 6-ft. Folding Rule and Folding Yardstick

The Hardest Metals Made by Man

[*Continued from page 162*]

But tungsten-carbide bits drill up to 400 times as much hole-footage as steel before showing wear, may provide the key that will unlock our low-grade ores. And the Mesabi's low-grade fields, it is estimated, contain enough iron to meet the nation's requirements for centuries—one answer to the gloomy prophets who predict the earth's imminent depletion.

One Carbide Bit Beats 284 Steel Ones

Not long ago a Pennsylvania soft-coal mine placed one of the new carbide bits in service alongside one made of steel. The new bit speedily outdistanced the old type, drilled on and on while 284 successive steel bits blunted and had to be discarded. Thanks largely to the carbide-tipped mechanical equipment already in use, the average American soft-coal miner now digs seven and a half tons a day as against five tons before World War II.

Far more spectacular increases will soon be achieved with the new "continuous miners"—molelike carbide-toothed mechanical monsters that crawl along on caterpillar treads, bite out their own 20-ton weight in coal every 10 minutes, and multiply production per underground worker as much as 10 times.

At America's biggest gold mine—the famed Homestake in South Dakota—carbide rock drills have doubled recovery of pay dirt. And on the Canadian Northwest's fabulous Kitimat project, carbide-equipped crews are drilling a steep 10-mile tunnel through the heart of a mountain, to carry the water which will power the largest aluminum smelter on earth. Last winter they smashed the world's all-time tunneling record, ripping the big Kitimat bore—tall enough to accommodate a two-story house—through 282 feet of living granite in a single work week.

In the oil fields, too, carbide bits drill many times more footage than steel bits

[*Continued on page 282*]

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Best of Show

wherever lawn mowers are judged

SAVAGE Rotor Chief® TWENTY

Model 88 • 20" cut • New 4-cycle 2 hp Briggs & Stratton engine • Also on 18" rotary, Model 83, 1.6 hp • Both feature attachable leaf mulcher *at no extra cost.* And an electric: SAVAGE Dyna Chief® EIGHTEEN, 1/3 hp 3450 rpm motor • UL listed.

SAVAGE POWER MOWERS

Rotaries or Reel Types... Gas or Electric Powered

Any of the five *SAVAGE* power mowers, rotaries or reels, wins the nod from lovers of good lawns. Know why? It's because SAVAGE'S *gunsmith craftsmanship* means better built, more dependable power mowers. It's true. Precision SAVAGE power mowers cut lawns quickly and easily... less "lawn-time" means more time for leisure. Your SAVAGE will give you extra years of satisfaction with minimum upkeep.

Check and compare these features and you'll choose a SAVAGE: More rugged construction . . . exclusive "Sta-Temp" blades . . . adjustable handle with exclusive hill-climber hook . . . simple cutting-height adjustments... Briggs & Stratton 4-cycle engines . . . Timken reel bearings, "Self-Lube" wheel bearings... gas-powered rotaries feature "Toe-Tip" safety handle-latch to prevent roll-back on slopes... Electric rotary has two-way handle, ⅓ hp 3450 rpm motor.

Prefer a Reel-Type?

SAVAGE Yard Chief®

Model 90 • 21-inch cut • 1.6 hp Briggs & Stratton 4-cycle engine • And a model for smaller lawns: 18-in. 1 hp SAVAGE Power Chief® Model 75.

LEAF MULCHER—*Supplied with both gasoline-powered rotaries at no extra cost. Easily attached. Pulverizes leaves to small particles. No leaf raking, carrying or burning.*

FREE! **Write for SAVAGE folder on easier lawn care and facts and pictures of full SAVAGE line of power and hand lawn mowers.**

SAVAGE ARMS CORPORATION • Lawn Mower Division • 103 Broadway, Chicopee Falls, Mass., U.S.A.

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be the proud owner of this
IRWIN solid center auger bit set

bore holes easier, faster, cleaner . . . even in hardest woods

A time-saving, money-saving investment for hobbyist, professional, or handyman alike. Original solid center design for extra stability, extra accuracy, easier boring action. Made of special bit steel, heat treated and hardened full length to stay sharp. Brightly polished for good looks, pride of ownership. Carefully balanced for that good-to-work-with feel.

A practical investment for yourself. Makes a wonderful gift, too. Also available in 6 and 10 bit sets in hardwood chest, colorful plastic roll sets and individual sizes, ¼" to 1½". See your independent hardware dealer soon. The Irwin Auger Bit Company, Wilmington, Ohio.

Send for **IRWIN Hang-A-Bit Rack** only $1.00 postpaid

Durable steel construction. Easy to mount. Holds 13 Irwin auger bits in special steel clips — individually, firmly. Size-marking for each bit, ¼" to 1". Send $1.00 to Irwin, Dept. 2, Wilmington, O. No COD's. *Offer applies to USA only.* Quantity limited. Order now!

Ask for IRWIN when you buy

IRWIN the original solid center auger bit • screw drivers screw driver bits

The Hardest Metals Made by Man

[*Continued from page 280*]

before replacement. Since it costs $200 an hour to run an oil-well rig, carbide bits make oil prospecting a less costly gamble than it used to be, may speed the search for new American oil reserves.

Titanium Carbide May Be Wonder Child

Today's jet engines operate at about 1,500 degrees Fahrenheit. If the operating temperature could be raised, the engine's power would be greatly increased. But where do you find an alloy capable of withstanding such a super-engine's 2,200-degree furnace breath? In laboratories all over the world the race is on.

At least one major American carbide producer thinks that it may have the answer already—in a remarkable cross between carbon and the "wonder metal" titanium. Like its titanium parent, titanium carbide is one-third lighter than steel, two-thirds lighter than tungsten carbide.

Moreover, being the hardest of all the cemented carbides, it is the hardest single metal on earth, and fabulously heat-resistant. So far no complete jet engine made of titanium carbide has been built. But experimental turbine blades and engine valves have survived tests at temperatures well over 2,000 degrees Fahrenheit.

Archaeologists name the stages of advancing civilization for the tool material which made each possible—the Stone Age, the Bronze Age, the Iron Age. It is not farfetched to say that mankind has entered the Carbide Age. We have reached a new milestone on the road to abundance, thanks to man's close approximation of the long-sought Excalibur: the tool that never dulls. END

A Point of View

"How far is it to the next filling station?" asked the motorist at the farm house.

"Five miles as the crow flies," replied the farmer.

"But how far is it if the crow has to walk and carry a can of gasoline?"—*The Wyatt Way.*

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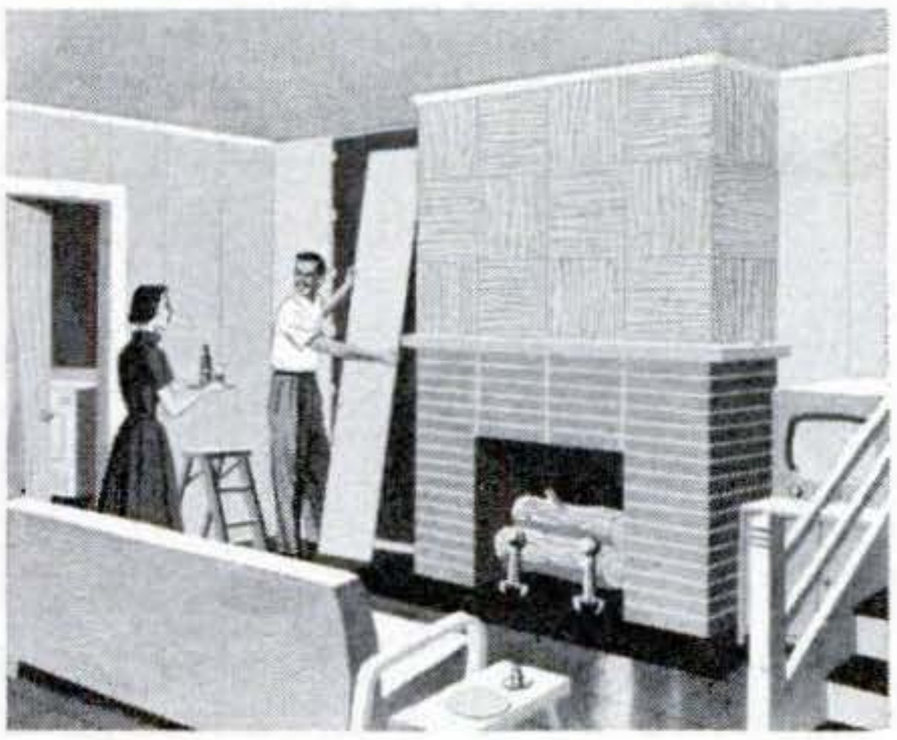
REMODELING'S EASY



with beautiful, new prefinished

MARLITE PLANK & BLOCK

Put them on the wall—that's all! Planks (16" x 8') and Blocks (16" square) go up fast over old or new walls with ordinary carpenter tools. No adhesive needed. An exclusive tongue and groove joint conceals all fastening. The soilproof baked Marlite finish never needs painting; cleans with a damp cloth. Ten beautiful "Companion Colors" styled by Raymond Loewy Associates, plus 4 distinctive wood patterns, are economical and practical for every room!

FREE! *Mail postcard for folder and do-it-yourself instructions. Marsh Wall Products, Inc., Dept. 326, Dover, Ohio. Subsidiary of Masonite Corporation.*

MARLITE PLANK AND BLOCK PATENT APPLIED FOR

Marlite®
PREFINISHED
WALL and CEILING PANELING

Favorite of home owners and craftsmen for 20 years! SPEEDY SPRAYER gives your work that professional paint finish everyone admires. Sprays paint, enamel, varnish, lacquer, etc. . . . 4 to 7 times faster than hand brushing! Lightweight, portable, uses any ¼ H.P. motor. Improved diaphragm principle assures clean, oil-free air. You'll find dozens of time and money saving uses for SPEEDY SPRAYER, including spraying insecticides 2-4-D and DDT. Complete outfit, without motor, only $36.50

$36.50
Less motor

At leading hardware, lumber, and auto supply dealers.
FREE—*write for handy booklet "How to Spray."*

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2637 N. Normandy Ave. • Chicago 35, Ill.

NEW . . .

THE SMOOTHEST 24" BALL BEARING JIG SAW EVER DESIGNED!

NOW YOU CAN WORK Magic with WOOD, METAL OR PLASTICS

New appearance . . . NEW engineering . . . NEW accuracy and efficiency. Every part of this saw is newly designed to minimize vibration and promote smooth, clean, accurate cuts. Has tremendous capacity . . . handles wood, metal, plastics, compositions, bone, ivory . . . cuts up to 2¼" thicknesses . . . has 24" throat capacity . . . blade turns 90° for cutting long stock, and arm is removable for sabre cutting panels of any size . . . massive 14" x 14" precision ground table is supported on big, widely spaced trunnions to give the rugged foundation needed for heavy work . . . table tilts 45° right, 15° left, and swivels 90° . . . operates at four speeds suited tc different materials.

And it's the smoothest running jig saw ever . . . has scientifically balanced mechanism, drive shaft that turns on two ball bearings, spinning blade support, complete splash lubrication, and exclusive spring steel hold-down that keeps work firmly in position. See it at your ATLAS franchised dealer's·· you'll agree that no other jig saw compares with the new ATLAS No. 4002.

you can DO so much MORE so much BETTER with

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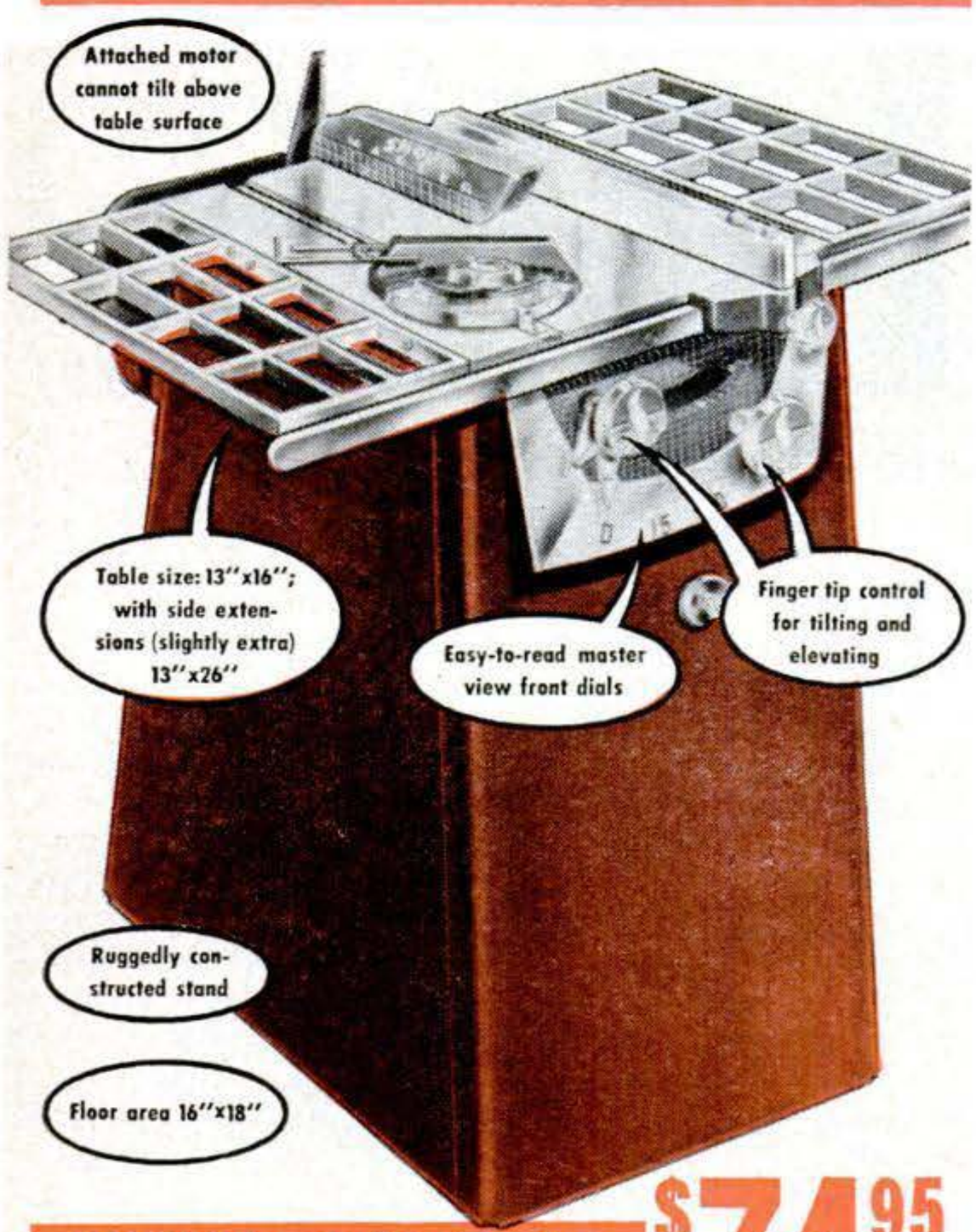
Shopmaster
SPECIAL FOR HARDWARE WEEK
PLUG IN
Floor Model TILTING ARBOR SAW
Including Attached 1/2 HORSEPOWER MOTOR



$99.95 Value Specially Priced at $74.95
A $25.00 Saving During Hardware Week, April 16-24

SHOPMASTER scores again! First with a ready-to-use . . . ready to plug in Floor Model Tilting Arbor Saw. It's ideal for your home shop. Take it home . . . plug it in . . . and start sawing.

It's a precision tool, simple enough for even the beginner, yet accurate and efficient enough for the professional hobbyist.

Every feature of the new SHOPMASTER Floor Model Tilting Arbor Saw is designed for easier operation. Attractive, easy to read master view controls provide unusual accuracy, eliminates guesswork. Novel transparent plastic guard gives 100% visibility for precision cutting. Cuts up to 2½", tilts to 45° has ½" arbor. Sealed for life ball bearings. Special motor mounting provides easy rail adjustment even when motor is at 45°. ½ H. P. 1725 standard speed attached motor is included in price.

MAIL COUPON FOR FREE CATALOG

SHOPMASTER, INC. Rm. 111
1214 South 3rd St., Minneapolis, Minn.
Please send me a free catalog.
Name _____
Address _____
City _____ State _____

America's Toughest Railroad

[Continued from page 168]

extra-large windows for sight-seeing.

Although the company has a roster of 17 steam locomotives, seven do most of the heavy work on the mountain. The 70-class steamers, with their brick arches and front-end throttles, are the most reliable power when snow piles on the killing grade.

Yukon Population Is Doubled

The population of the vast Yukon today numbers only 10,000 people, but this is twice what it was before World War II. White Pass freight now amounts to 90,000 tons a year, a huge increase over prewar activity. Most of the railroad's 400 employees live in Whitehorse, which today, with a population of 3,600, is more than five times as big a town as it was in 1942. Here cargo is transferred from the diminutive boxcars to riverboats and to trucks which operate over a network of wilderness roads spawned by the Alaska Highway.

Fabulous Freight for the WP & Y

Although the Yukon Territory has been associated in the public mind exclusively with gold, it also teems with silver, lead, zinc, tungsten, nickel and possibly uranium. As this mineral treasure trove is developed, there will be only one efficient way to hurry the ores and concentrates down to the sea for 12 months of the year—over the ribbon-like, 36-inch tracks of the White Pass & Yukon.

Meanwhile, residents of this last great frontier wait for the first resonant bray of a diesel's whistle. It will echo into Whitehorse from the tracks that rim the rapids of Miles Canyon, where a curly-headed boatman named Jack London piloted the rafts and canoes of pioneer gold seekers long ago. END

Safety or Sanity

MOUNTAIN climbers rope themselves together because there's safety in numbers—also it keeps the sane ones from going home.—*The Pure Oil News.*

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- Ready-to-use
- Fast drying
- High tensile strength
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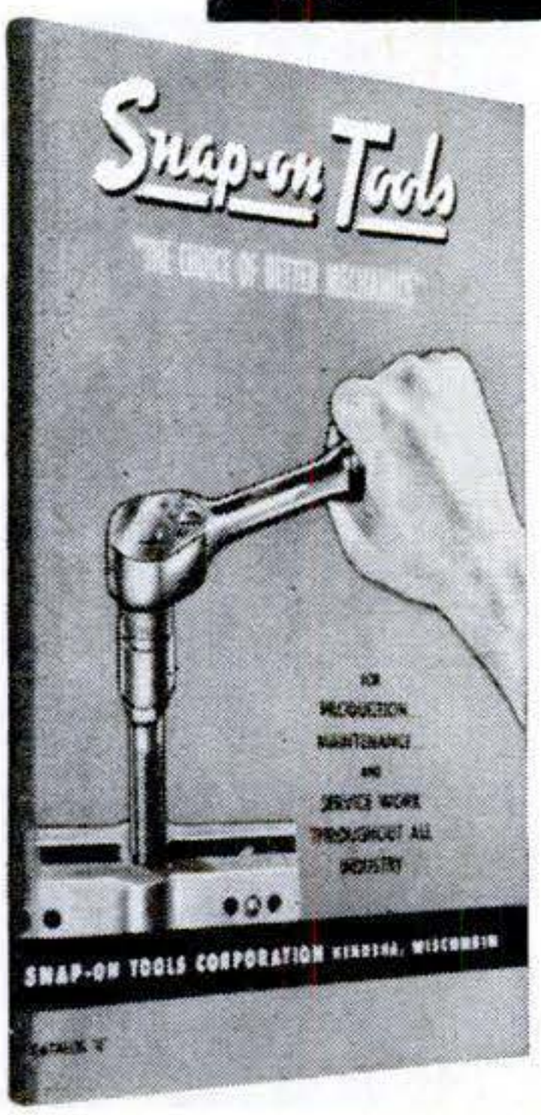

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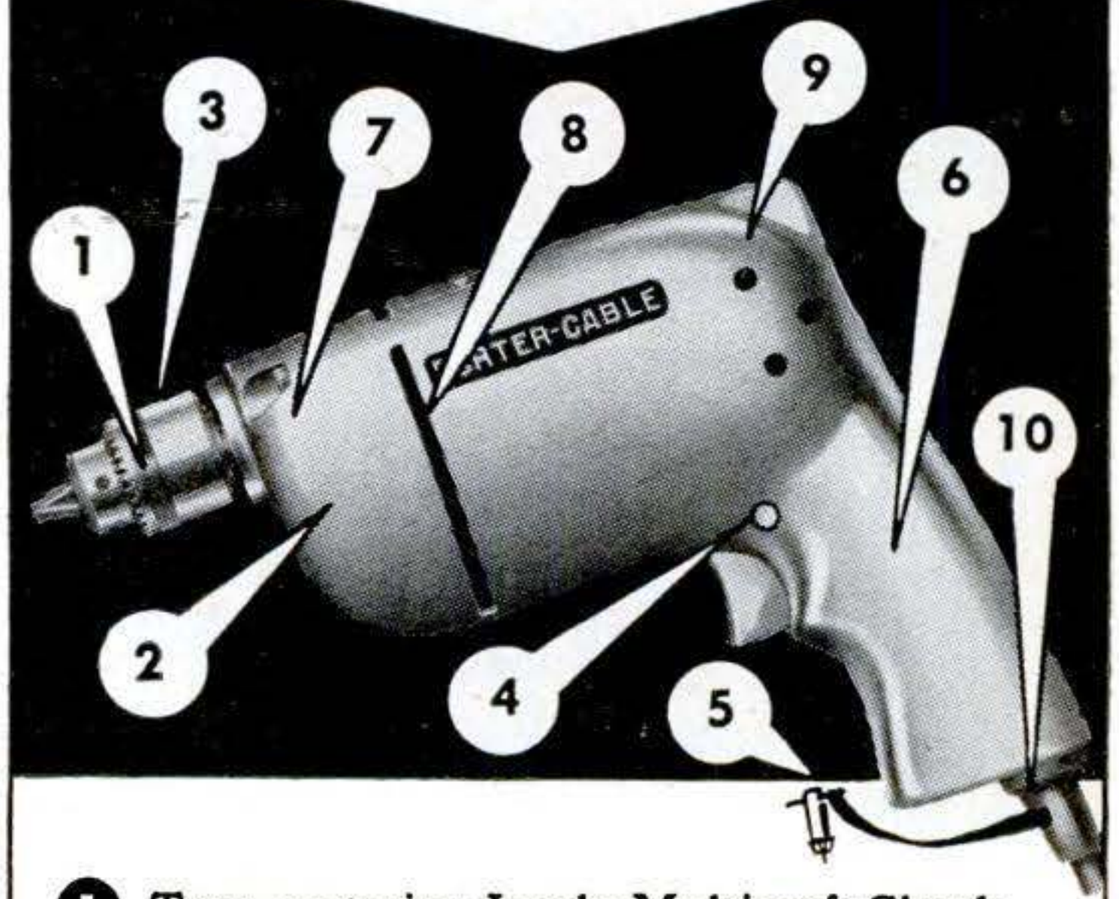

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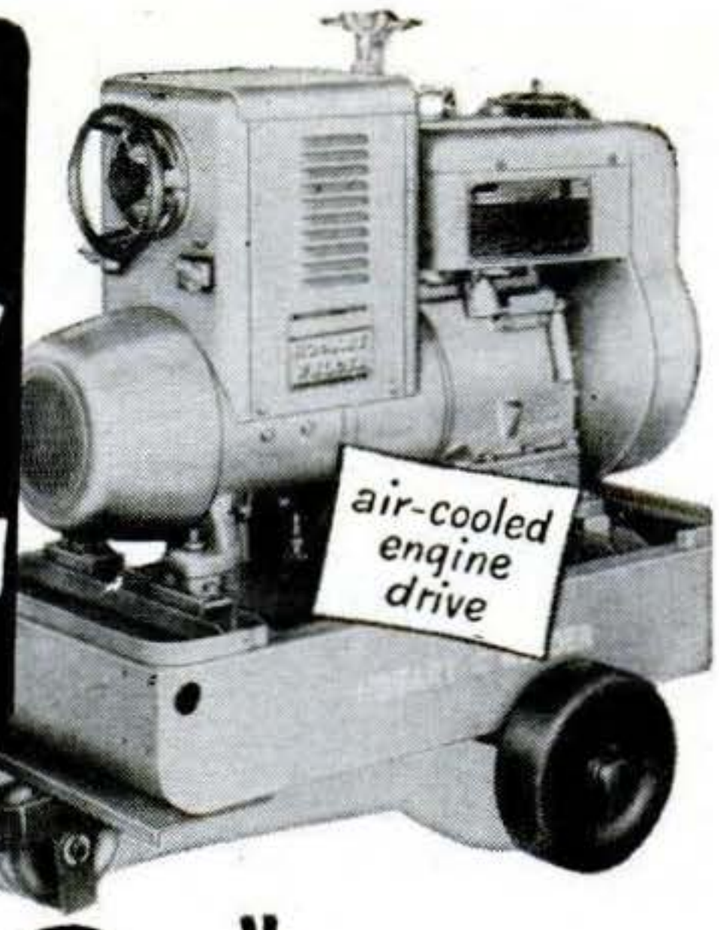

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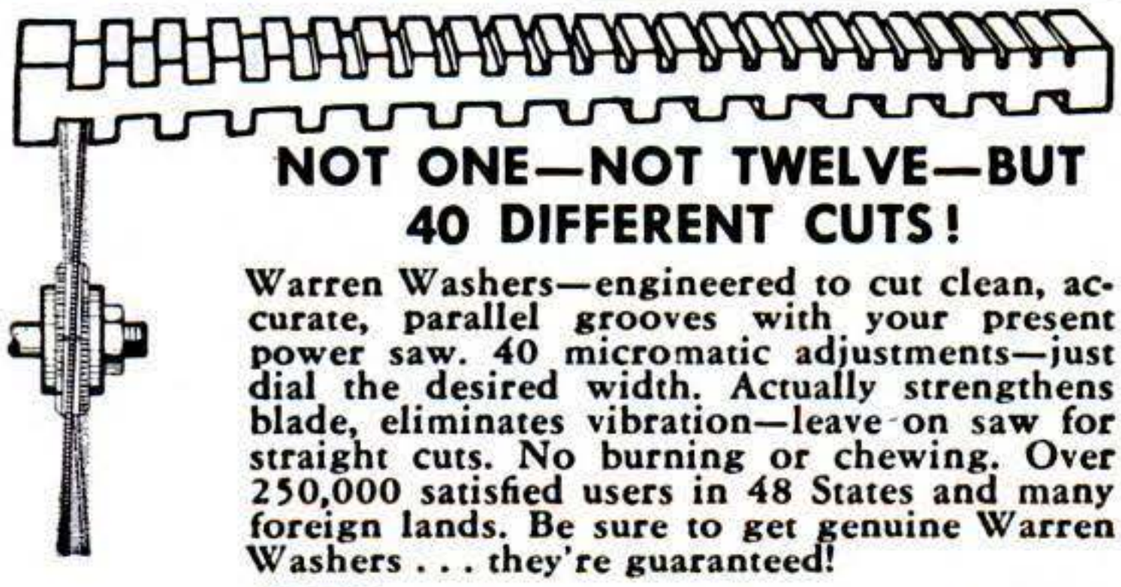

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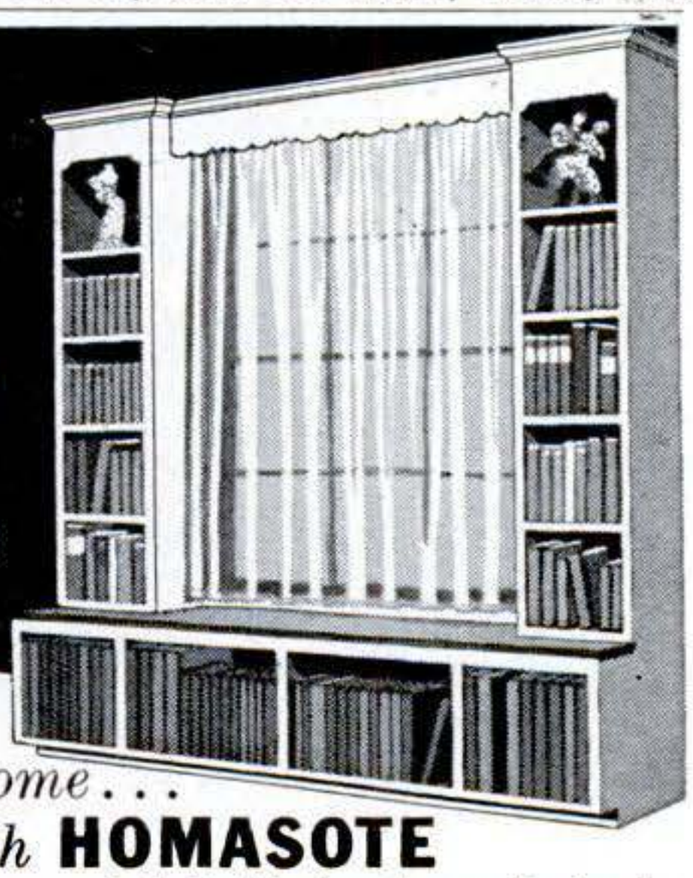

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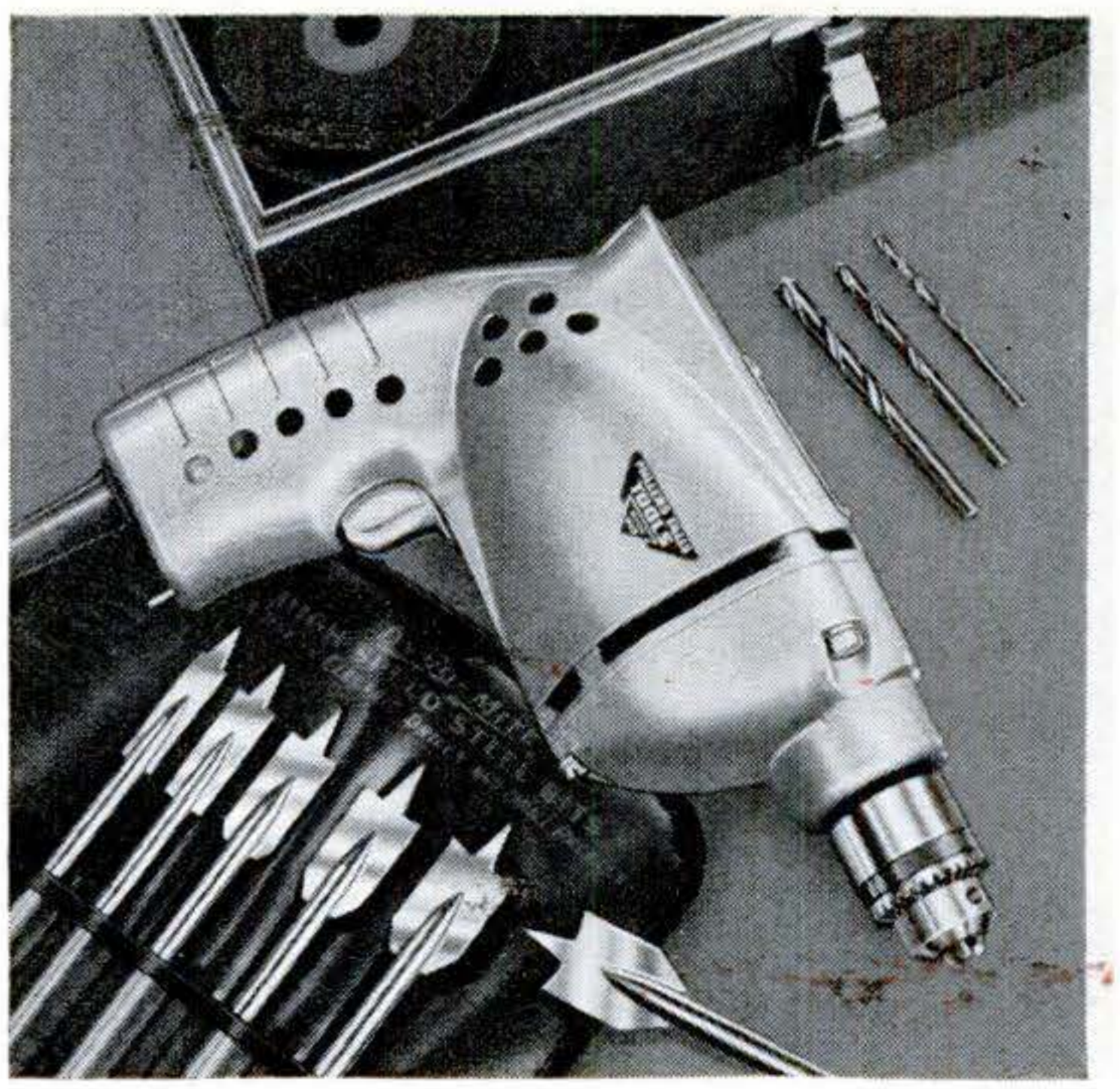

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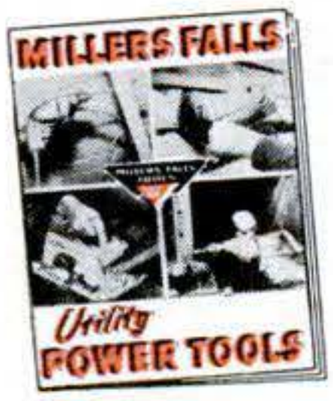

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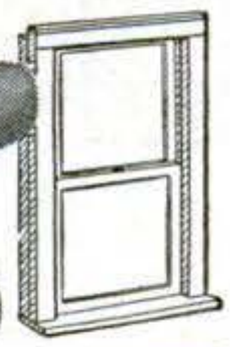

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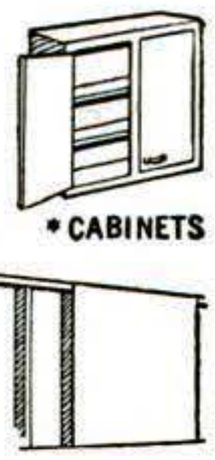

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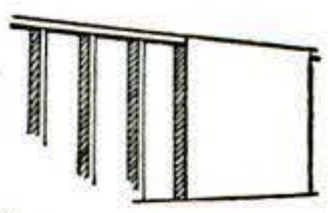

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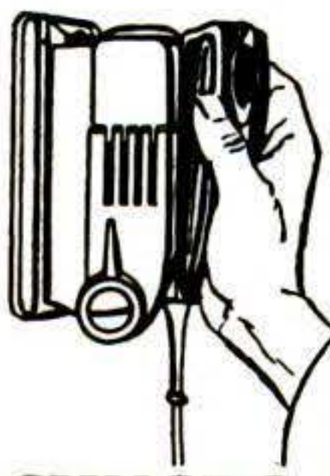

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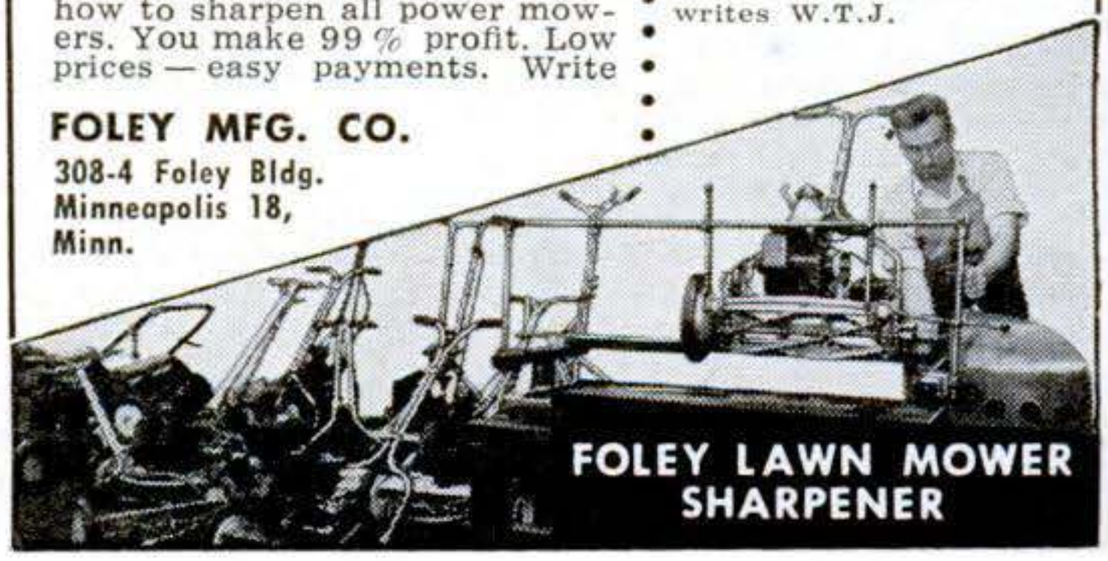

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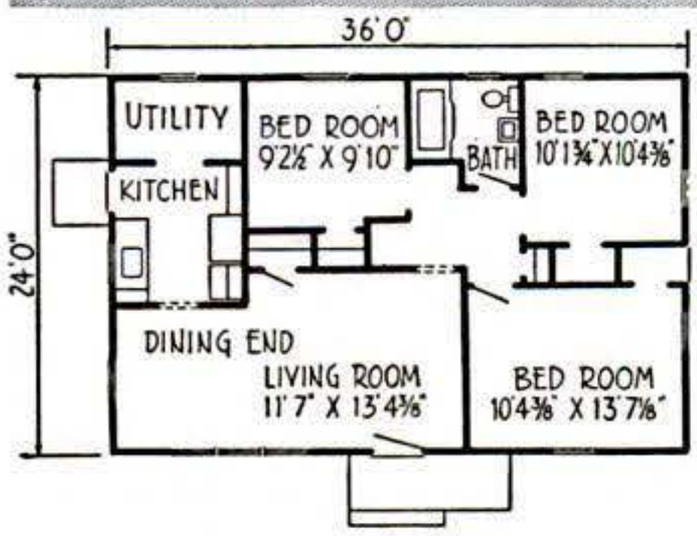

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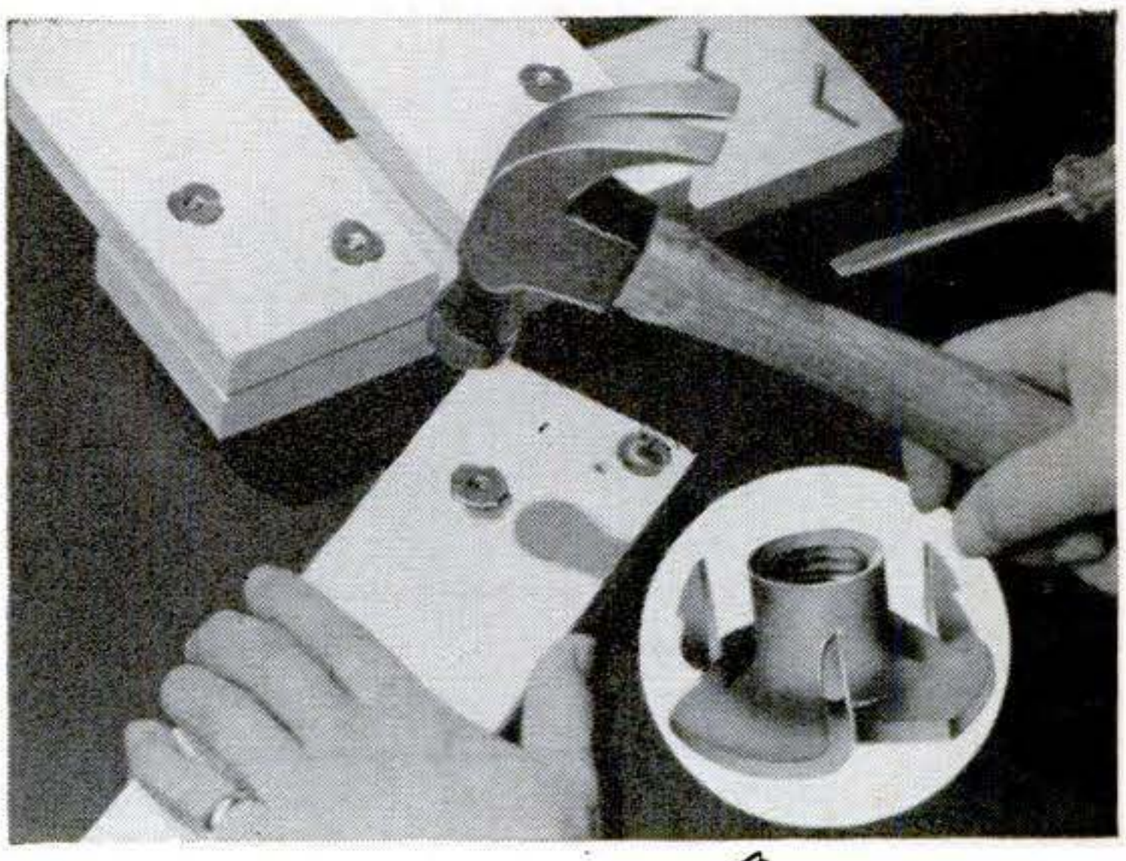

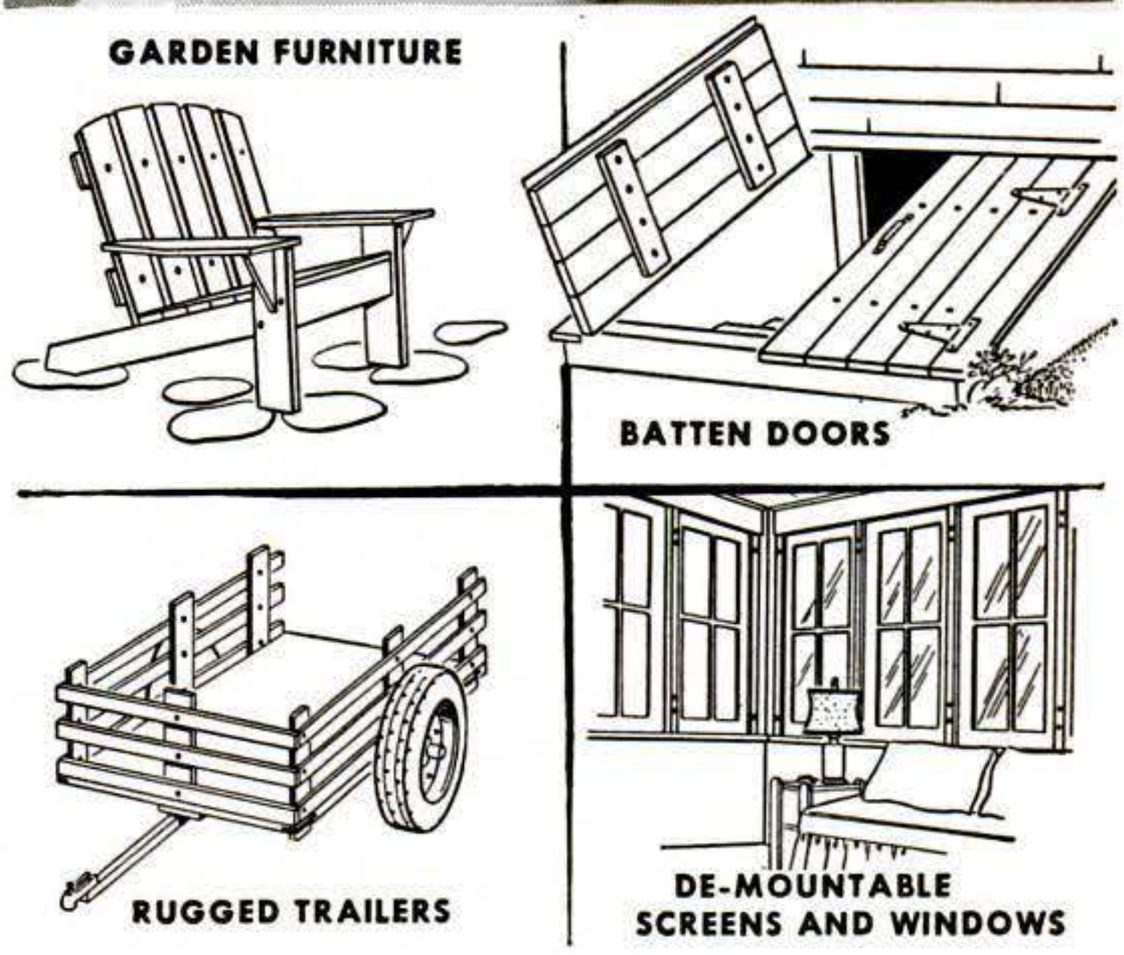

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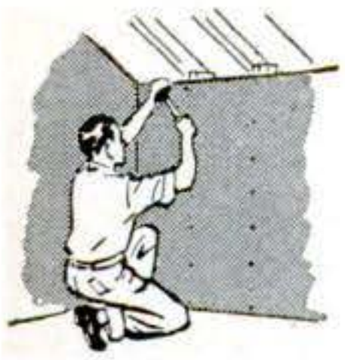

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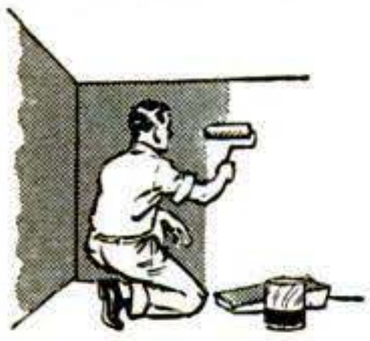

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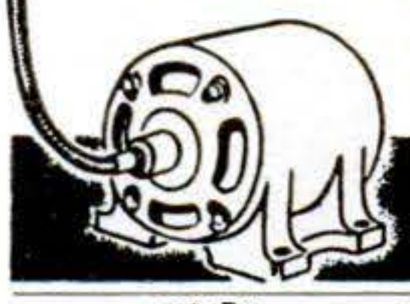

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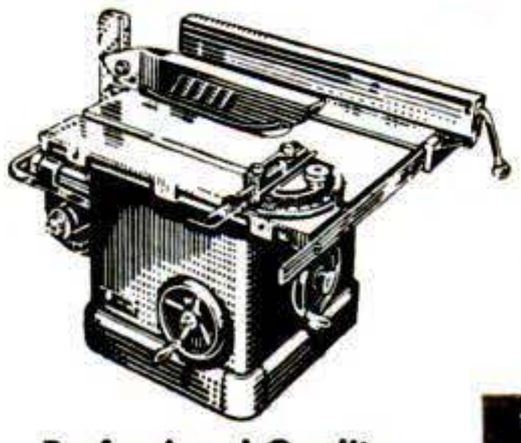

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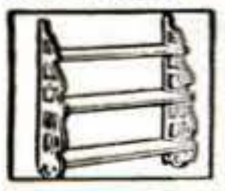

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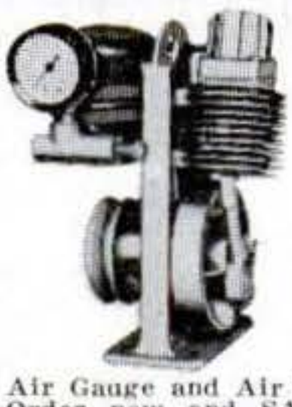

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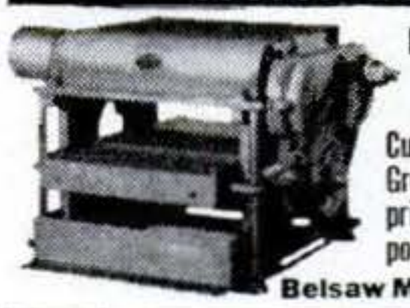

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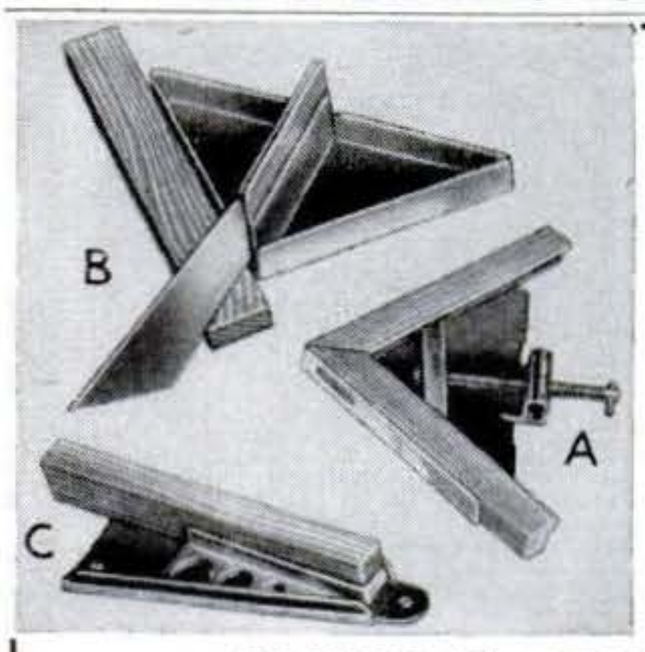

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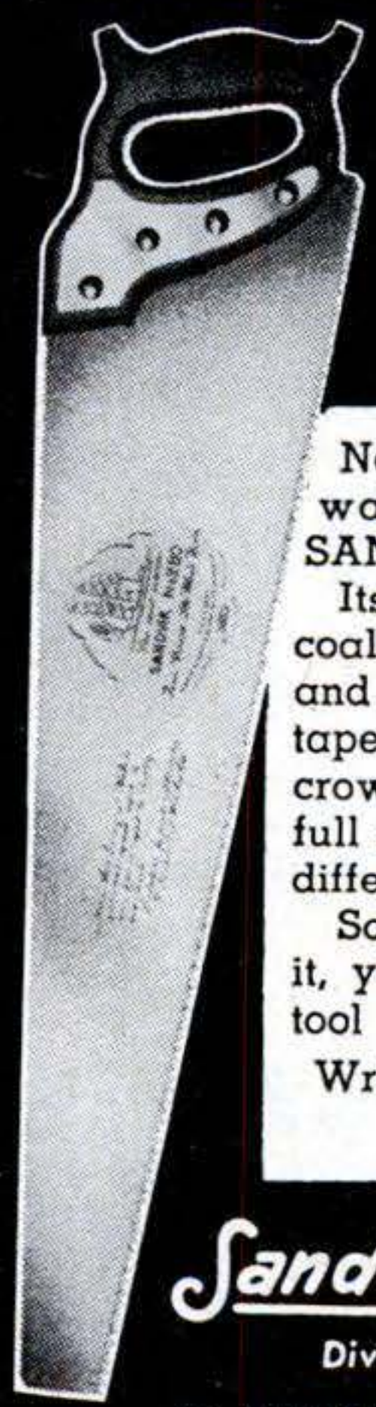

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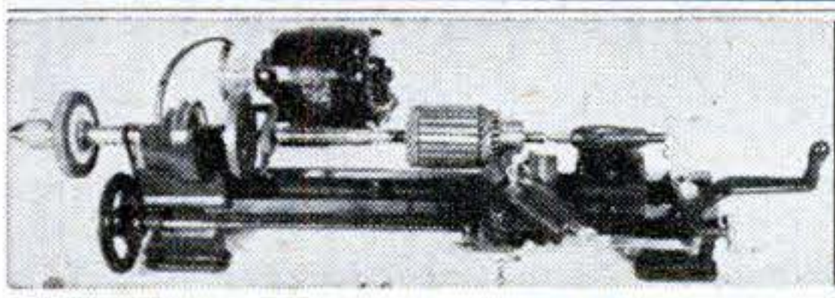

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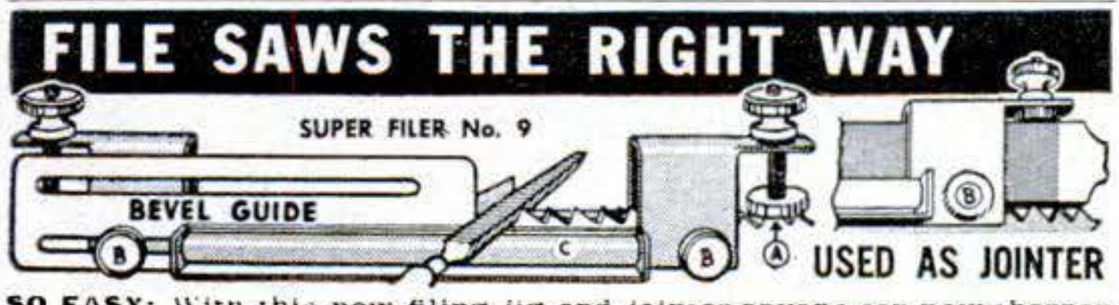

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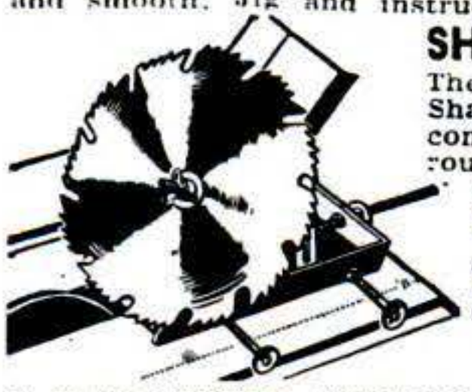

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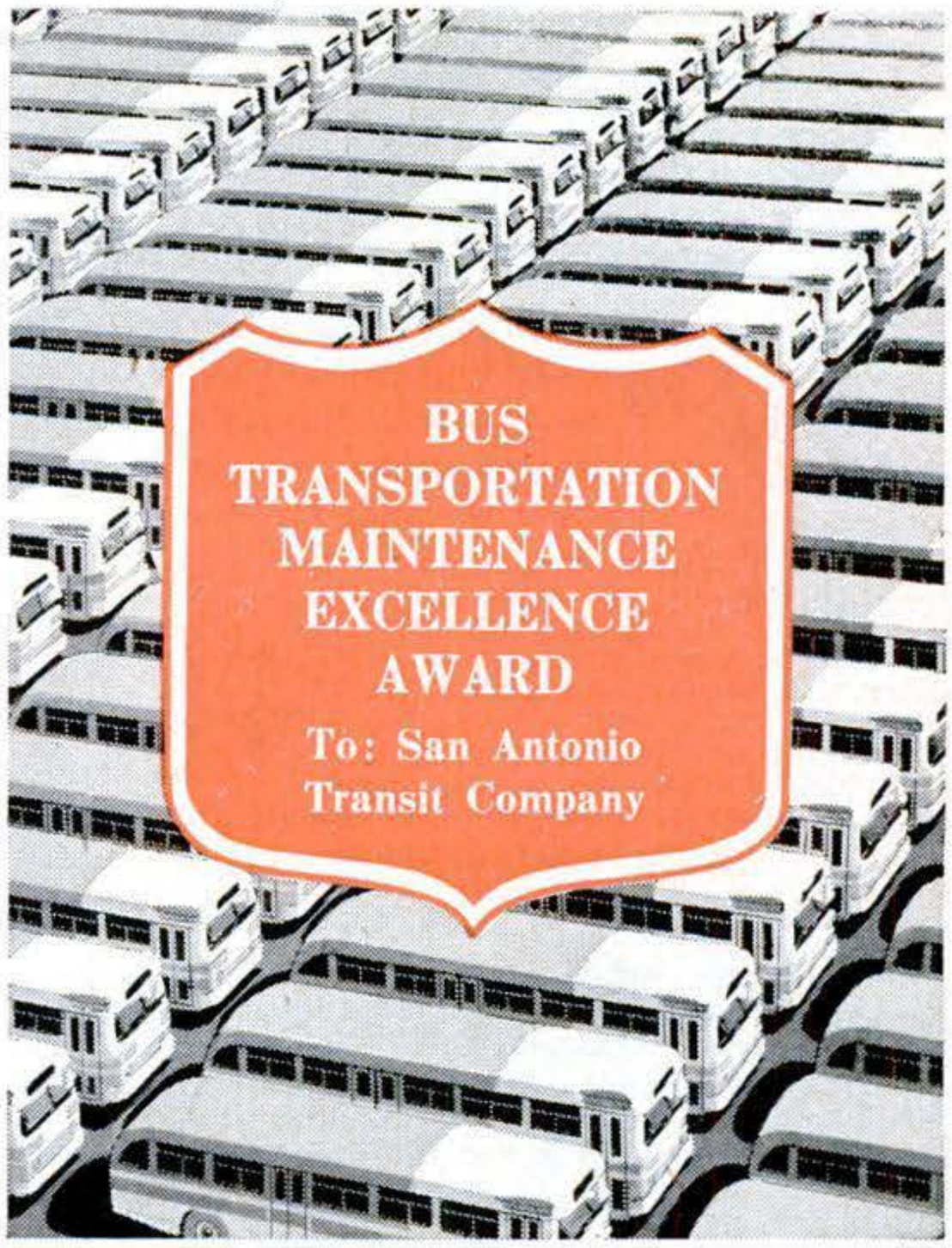

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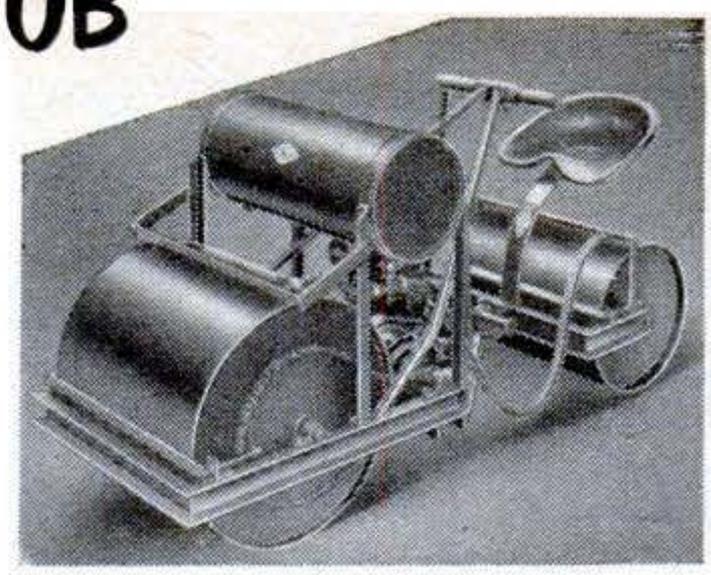

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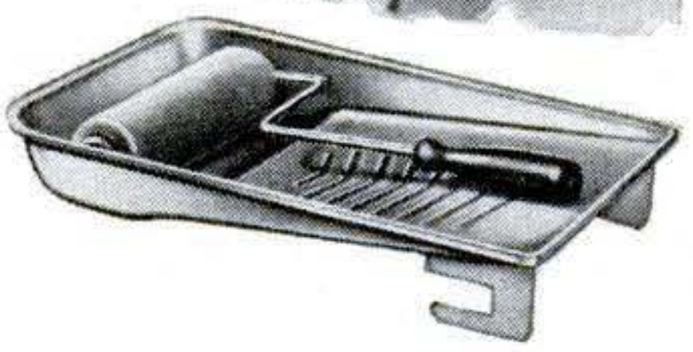

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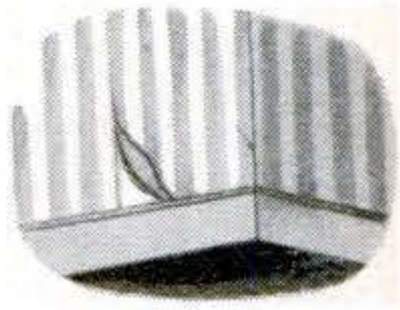

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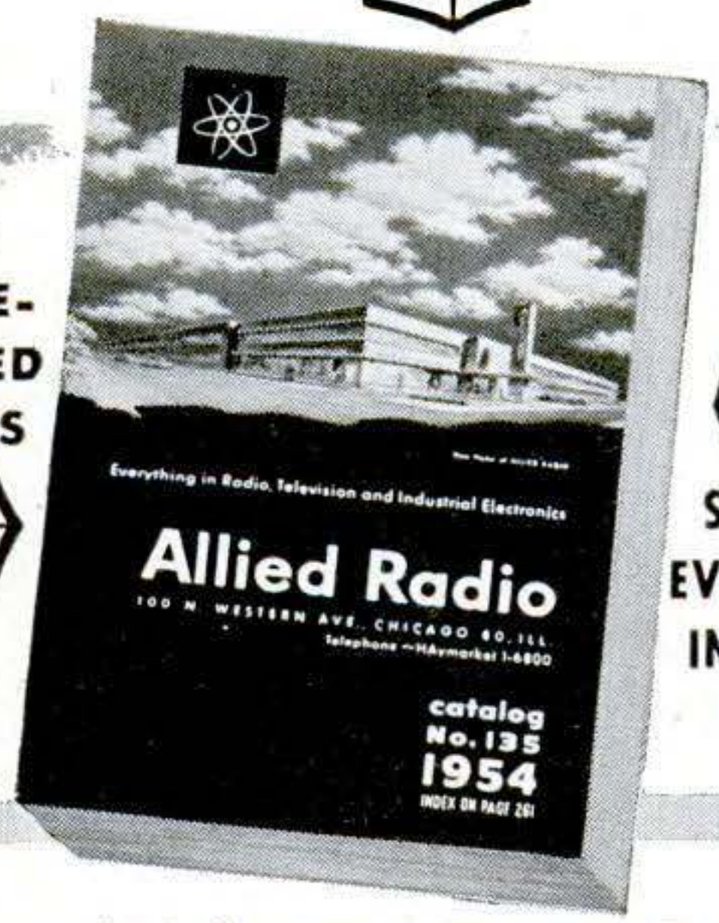

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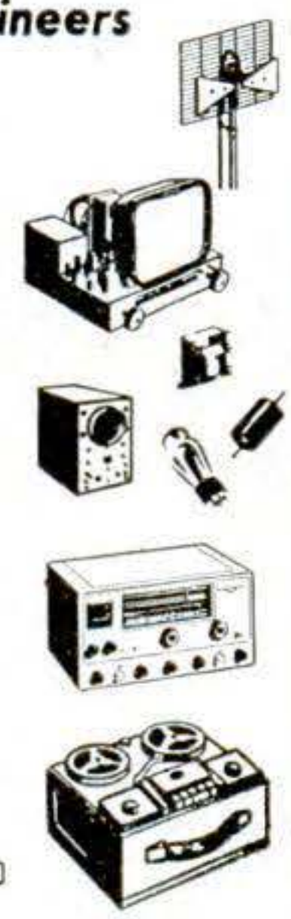

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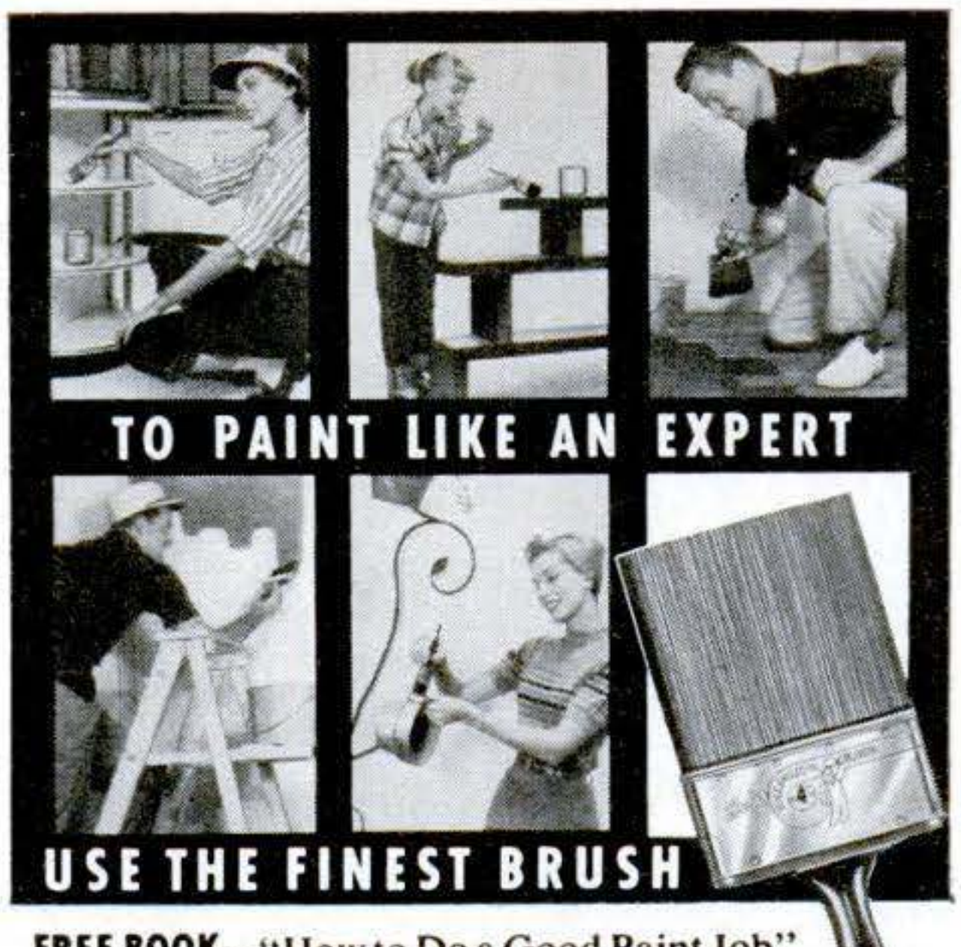

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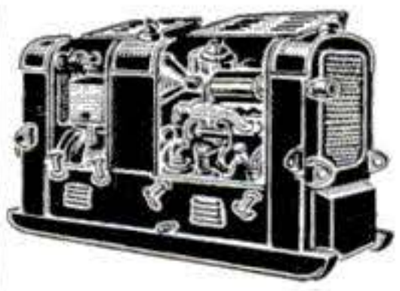

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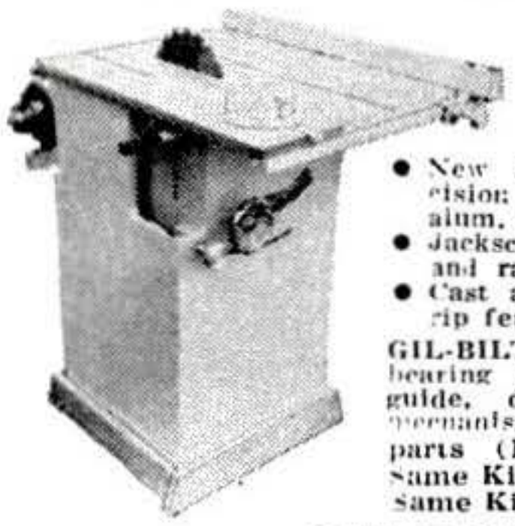

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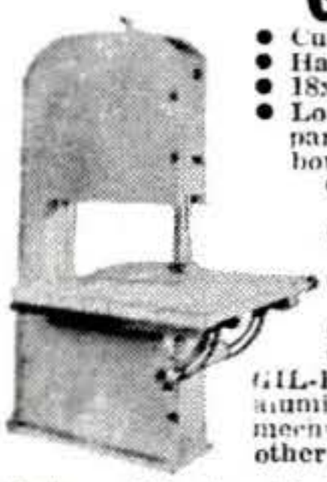

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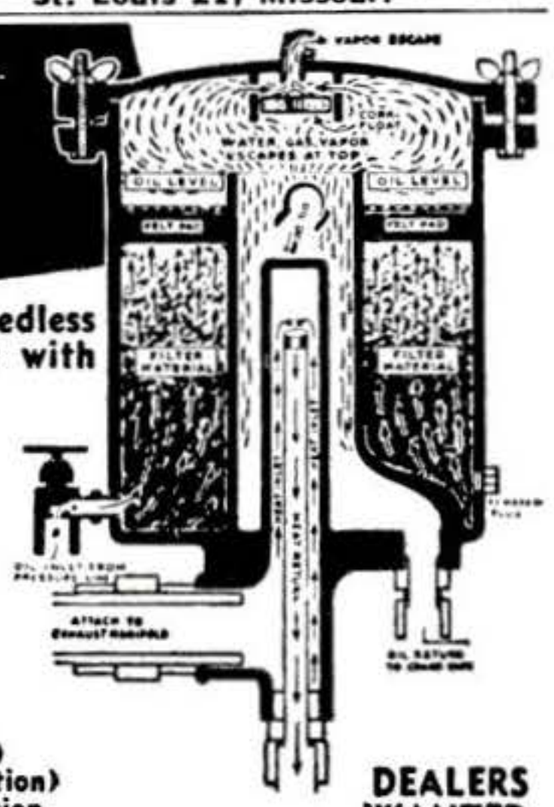

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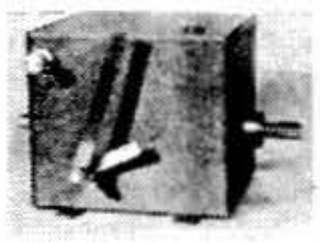

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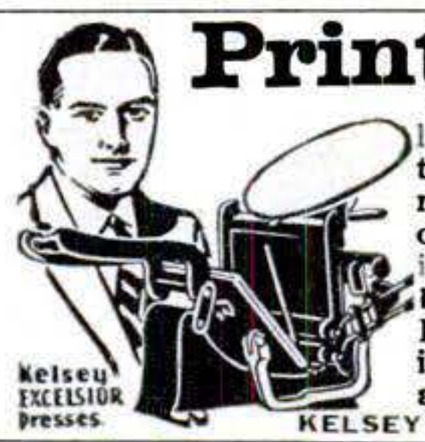

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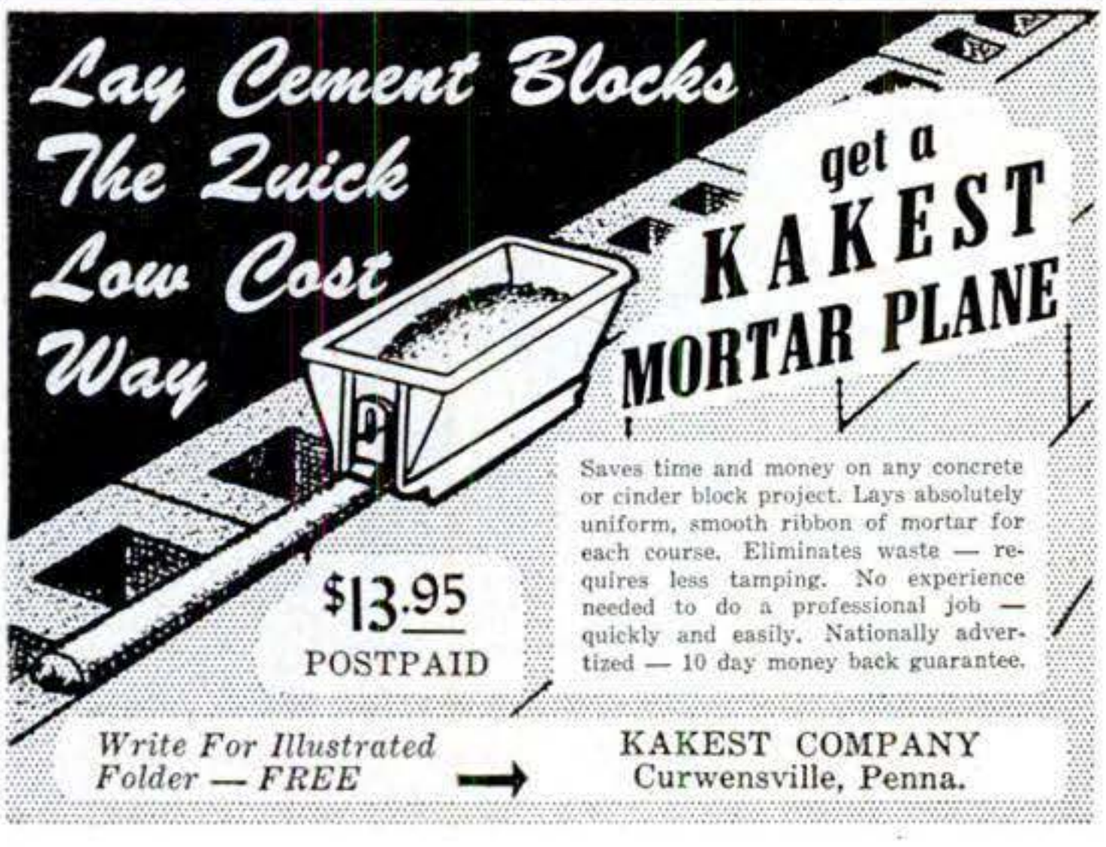

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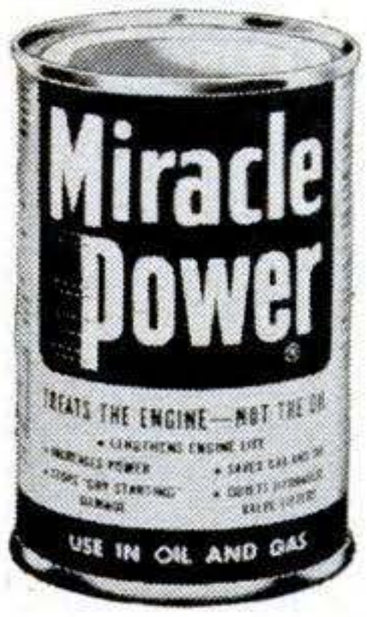

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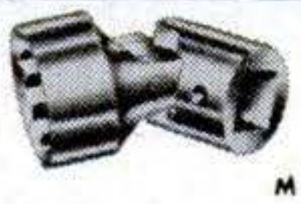

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Molly Screw Anchors are a "must" for installing fixtures *securely* exactly where you want them—not where the studs are. Molly will hold where nails and screws won't—anywhere in any hollow wall construction. Mollys are neat,, easy to use, inexpensive. And fixtures can be removed for cleaning and be replaced. Are they really good? More than 50 million have been used without a dissatisfied customer.

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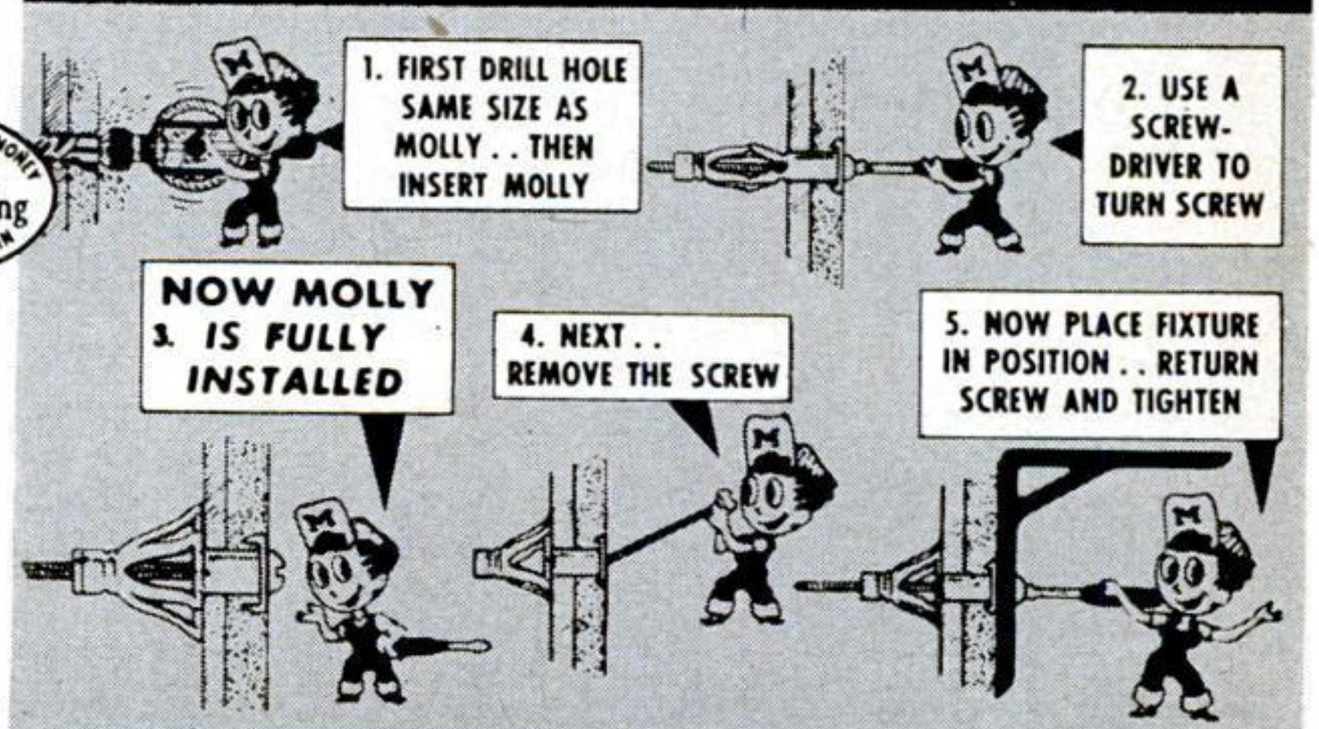
EASY TO INSTALL • NO SPECIAL TOOLS NEEDED



SCREW ANCHORS

MOLLY CORPORATION • DEPT. C5 • READING, PA.

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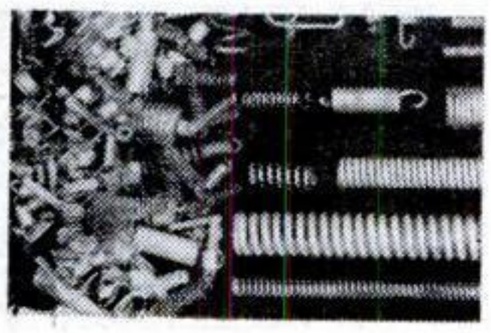

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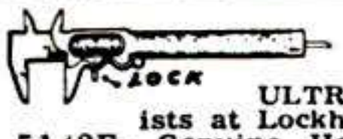

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Adjustable from 24 to 32 volts. For use with 24 or 32 volt D.C. Generators; also 200 Amp-300 Amp type generators to build your own light plant. Marine use. Westinghouse. Wt. 2½ lbs. Approx. GOVT. COST $50. Now only **$4.95 ea.**

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R1 Jack & Heintz. Rated 300 Amps. 30 Volts. Wt. 60 lbs. Approx. Govt. Cost $450 Guaranteed perfect **$23.50**

MAKE YOUR OWN ARC WELDER Package consists of 1 NEW Auto-Lite P1 generator, 1 giant toggle switch, 1 voltage regulator, wiring diagram chart showing conversion of Aircraft Generator to Arc Welder. SPECIAL—**$29.50**

MICROMETERS Chrome plated, precision engineered, carefully tooled to give long life. All new 0-1" cap. $2.25 ea., 1-2" cap. $3.50.

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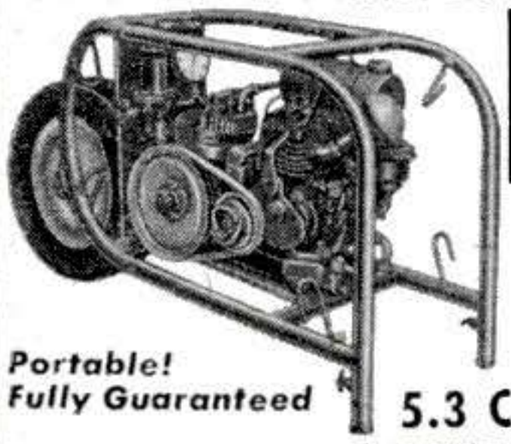

AIR COMPRESSOR

200 lb. Pressure, 2 Horsepower

Finest 2-HP TWIN CYLINDER Industrial Unit ever built! **$129.00** f.o.b.

Portable! Fully Guaranteed

5.3 C.F.M. Handles largest industrial and commercial applications

Made by BENDIX WESTINGHOUSE to rigid specifications. A BUY for Contractor, Farm, Garage, Service Station, Factory, Shop! Two independent air outlets—one for high pressure (up to 200 lbs.)—the other controlled by regulator from 0 to max. 5.3 C.F.M. supplies sufficient air to maintain 40 to 65 lbs. pressure for CONTINUOUS spraying (no waiting until tank keeps building up). Large face gauge. Adjustable Safety release valve. Automatic unloader (adjustable up to 200 lbs.) keeps pressure constant without stopping engine. Hollow frame acts as reservoir assuring large supply of OIL-FREE air with ABSOLUTELY NO PULSATION! Unexcelled for: Spraying; Greasing; Tire inflation; Blowing out heating and refrigeration lines; Small pneumatic tool operation; Insecticide dusting and spraying; Flocking; Undercoating!

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- 4 Rings on each piston for added compression — capable of pumping 1100 lbs. p.s.i.
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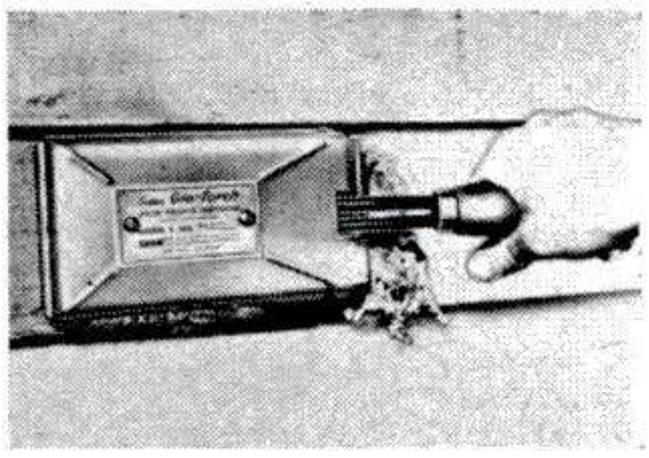

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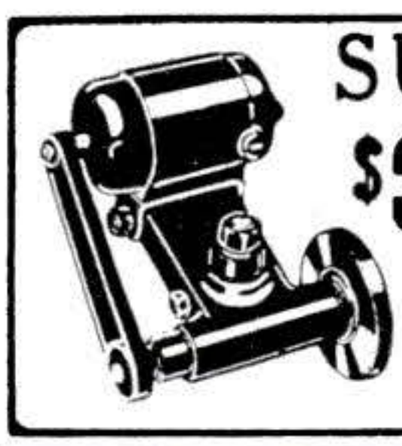

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5 pc. RATCHET BRACE and AUGER BIT SET.
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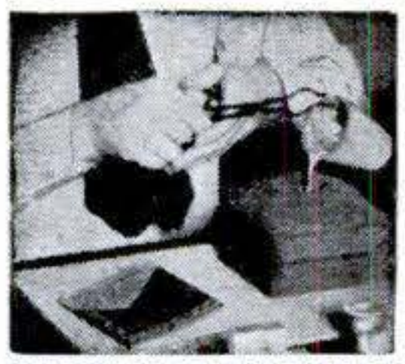

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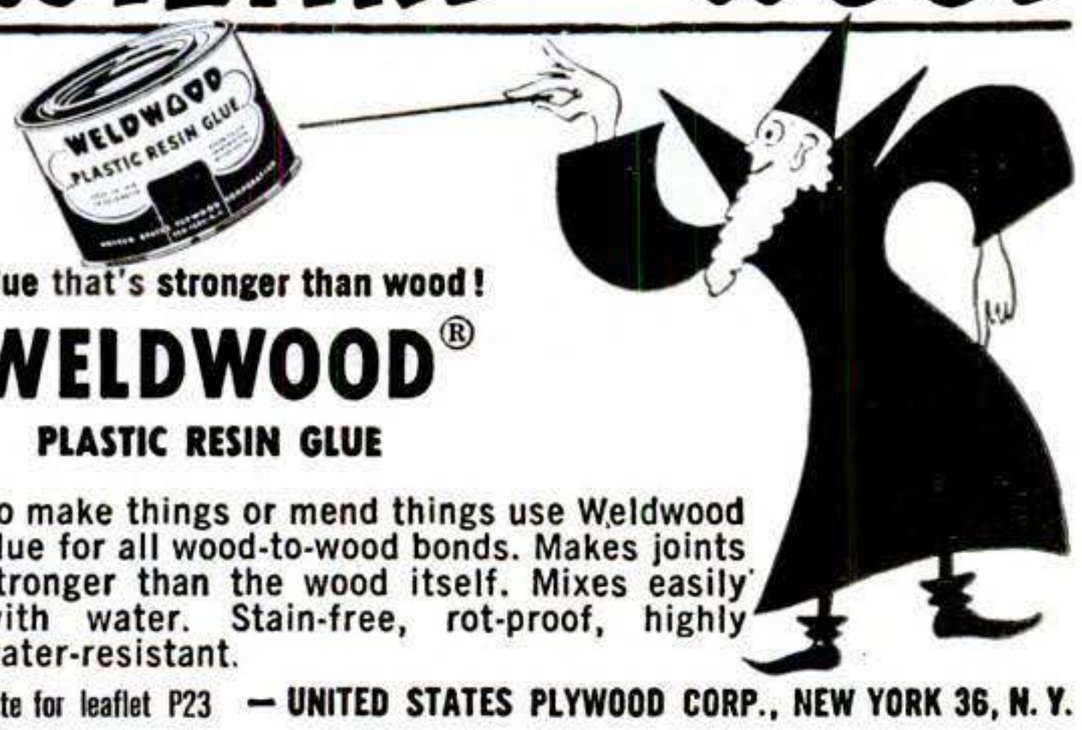

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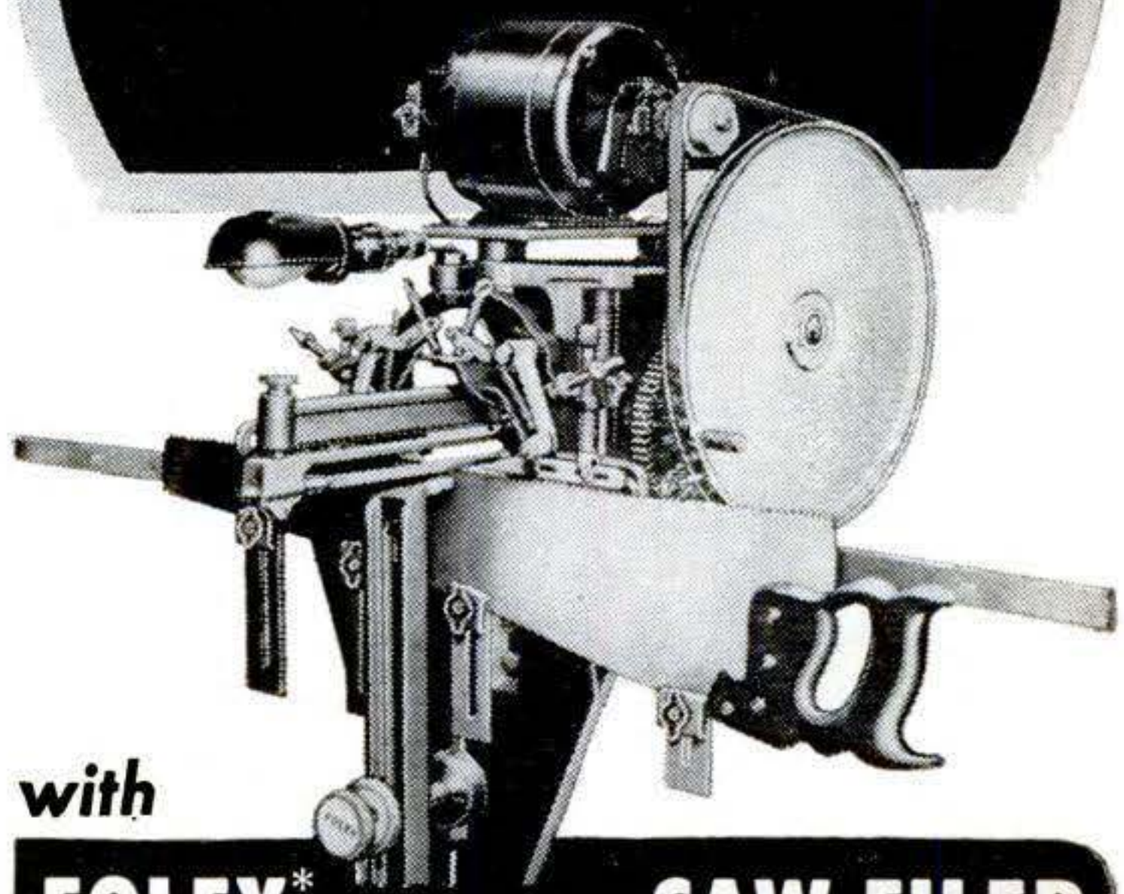

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**Trade Mark Reg. U. S. Pat. Off.*

"I did very well last year with my Foley equipment, about 950 saws in my spare time. About $900 for me."—Leo H. Mix. "I have done 4 or 5 thousand saws in my spare time in the 4½ years since I got the outfit, and they are all coming back with repeat orders."—says Len Crego.

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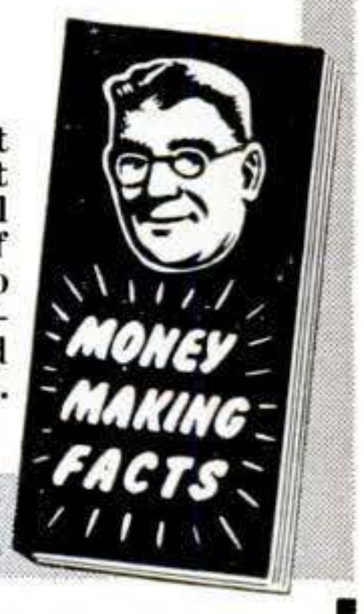

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THESE TWO AMAZING SAWS HAVE THE SAME FEATURES, DO THE SAME WORK AS OTHER SAWS COSTING $50 & UP!

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"ARCO-SAW"

Attaches in One Minute to Any 1/4" Electric Drill

"ARCO-SAW", the **only** saw attachment to whiz thru **2x4's in one cut,** cuts 8-times faster than handsawing. Just tighten **Safety-Yoke & Clamp** around drill and run this powerful saw with **one hand.** Build anything from a bookcase to a bungalow!

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BLADES—Safecut, Rip, Crosscut, or Combination. . **$1.75**

"ARCO JIG-SAW"

Does work of Jig, Keyhole, Coping, Rip, Band, Hacksaw!

EXCLUSIVE AIR-JET BLOWS AWAY SAWDUST.!

Here at last is a Portable Jig Saw that attaches in 1 minute to any 1/4" drill. Cuts intricate patterns, circles—no matter how large—in plywood, -wallboard, plastics, metals—**even lumber up to 2x4's!** Cuts openings **without starting hole.**

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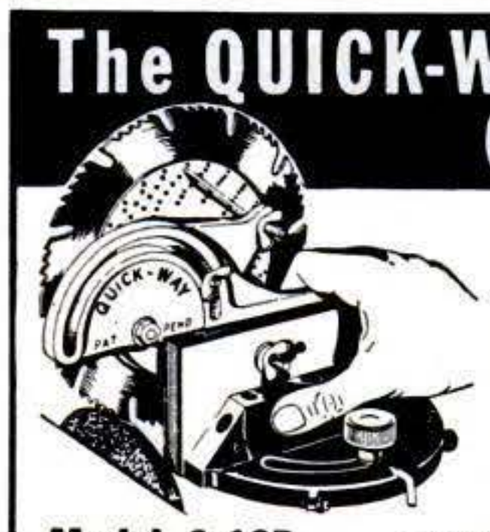

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Model 6-12P
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$15.50 used, good cond. Instruc. incl. for Comb. welder & light plant. 200 amps. 28 Volts. Or Brand New. Price **$21.50**

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CONVERTS TO ARC WELDER 200-250 AMP. OR LIGHT PLANT CAP. LOAD 5000 WATTS

Stock No. 711 D. C. Generator R-1 Jack & Heintz, rated 300 Amp. 30 Volts. Gov't cost $300.00. Instructions for converting to welder or light-plant incl.... **$27.50**

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Brand New including 24V. D.C. Motor. Gear ratio 4:1, can be adapted for 2:1, 40:1 & 20:1. Ideal GARAGE DOOR OPENER, HOIST, PUMP JACK, HAYLIFT, LAWN MOWER DRIVE, DRIVE FOR POST DRILL, etc. Gear unit applicable for 110 A.C. Diagrams & instructions incl. Gov't cost $221.00. Wt. 33 lbs. Only..... **$9.95** f.o.b. KCMo.

PESCO Centrifugal HEAVY DUTY PUMP Including built in motor, 1/4 H.P. Applicable for 24V. D.C./A.C. or 110V. A.C. The motor is explosion proof, constructed for gasoline fuel, oils, water, fuel booster, etc. 3/4" hose connection. Rated capacity, 400 G.P.H. Instructions incl. Gov't cost $172.00. **Stock #659**..... **$9.95**

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For operating hydraulic cylinders, motors on tractors, bulldozers, etc. Delivers up to 400 G.P.H. at 3750 R.P.M., 1250 to 1400 P.S.I. 3750 to 4500 r.p.m. Has built in relief. Gov't. cost over $150.00. Data incl. #37 **$17.50**

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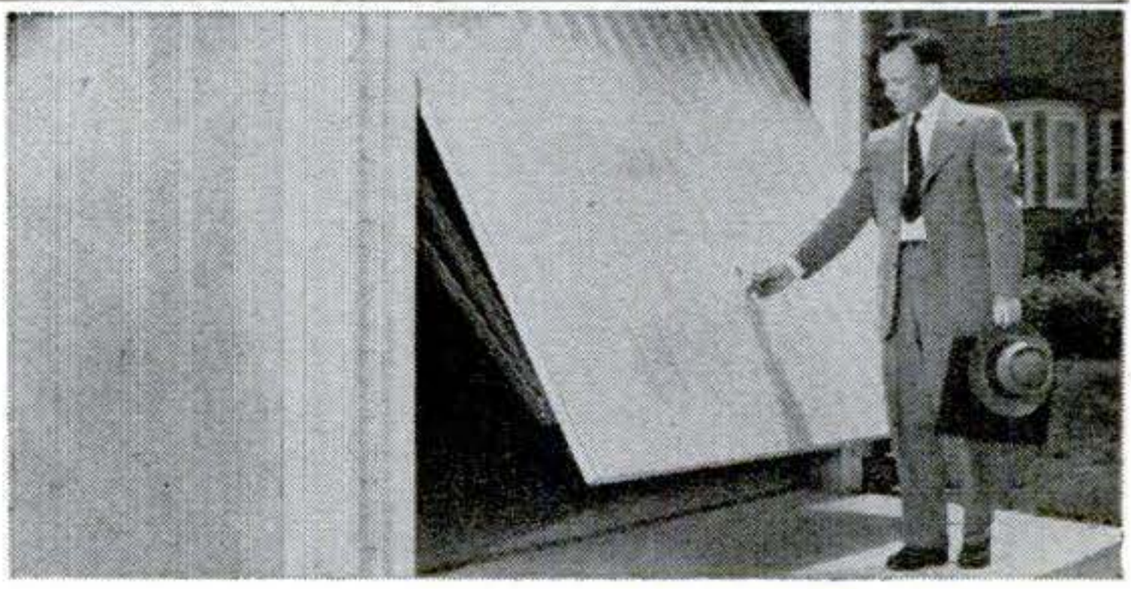

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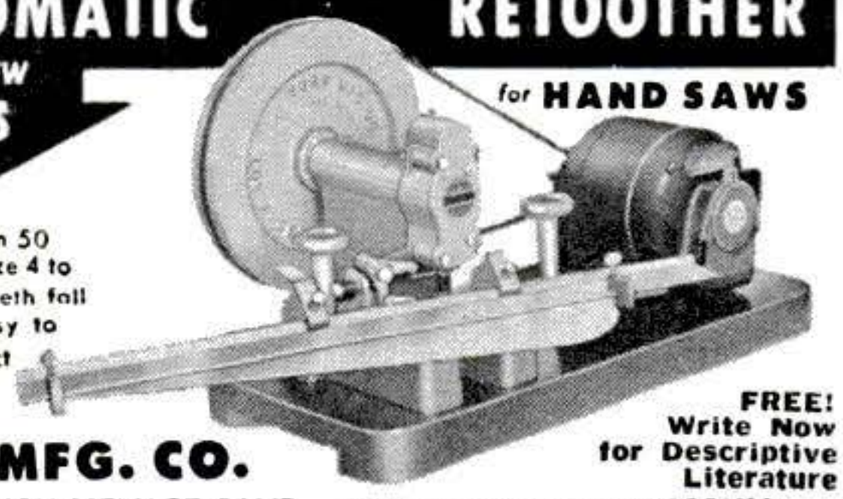

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The answer seems simple: appoint these dealers to take care of our new customers—but it isn't that easy. We need men with executive ability who can qualify as regional managers to help us decide which dealers should be appointed in the fastest-growing organization of its kind in the world. We also need distributors to handle warehousing and administration for our dealer network. If you have organizational ability and are financially responsible, we'd like to hear from you and discuss your opportunities with us.

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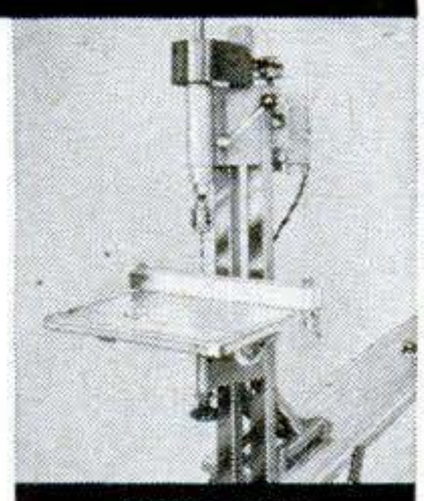

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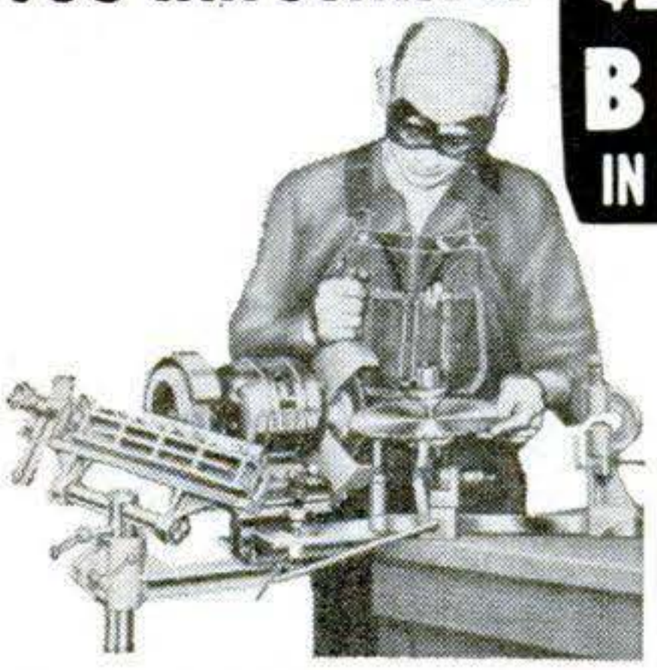

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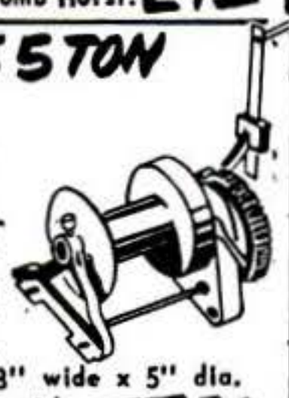

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ONLY **24.75**

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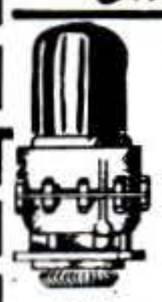

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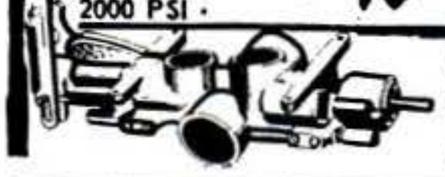

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Price for system of 2 sets . . . $29.95

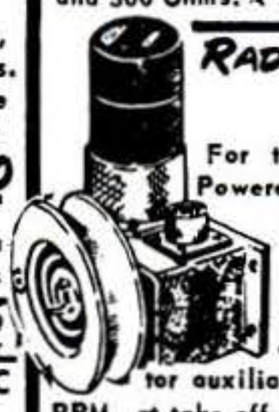
NAVY SOUND-POWER PHONE SET

Used by the Navy for flight deck and gunnery control. An ideal emergency communication system because they require no power supply. Perfect for office-to-shop house-to-garage or barn, or any point-to-point within 1/2 mile radius. These sets are fully sound powered. A set includes 2 phones on chest plate, two headsets, button switches, 35' of cable . . **9.95**

U.S.A.F. THROAT MICROPHONE

T-30-0- Consists of 2 microphones on rubber neckpiece. Operates on 100 to and 300 Ohms. A surplus value at $1.39

RADIO ANTENNA REEL



For tuning Beam Antenna. Powered by 1/8 HP, 24V, GE motor, engaged to gear reduction only when electrical contact is made. Will operate in either direction. Ideal for auxiliary power take-off. 150 RPM at take-off. May be used for opening and closing doors, etc. Cost Gov't approx. $125.00. NEW **8.75**

DC METERS

AMMETERS

0 – 30	0 – 240	30 – 0 – 30
0 – 60	0 – 480	50 – 0 – 50
0 – 120	0 – 300	60 – 0 – 60
		120 - 0 - 120

4.95 EACH

All Voltmeters & Ammeters are NEW and have 2" face (except 0-300 which is Used and has 3" face) Manufactured by Westinghouse, G.E., & Weston.

NEW VOLTMETERS 0-30 ONLY 4.95 EA.

NOTE: External SHUNTS are required on DC AMMETERS.

SHUNTS – with meter $1.35
SHUNTS – without meter . . $1.65

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Larger than ever before. Packed with SENSATIONAL VALUES in ***WAR SURPLUS, FACTORY CLOSE-OUTS*** and ***GENERAL MERCHANDISE!*** Included are thousands of items in Hand & Power Tools; Hydraulic Cylinders, Pumps, Motors, etc.; Hardware; Industrial Tools; Cameras and Photo Supplies; Outdoor and Sporting Equipment; Microscopes, Binoculars, Telescopes, etc. Foam Rubber, Aircraft Parts, Electrical Motors, Blowers, etc. Gadgets plus many, many more hard-to-find items.

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How Much Did You Learn?

By Sanford E. Taylor and Helen Frackenpohl

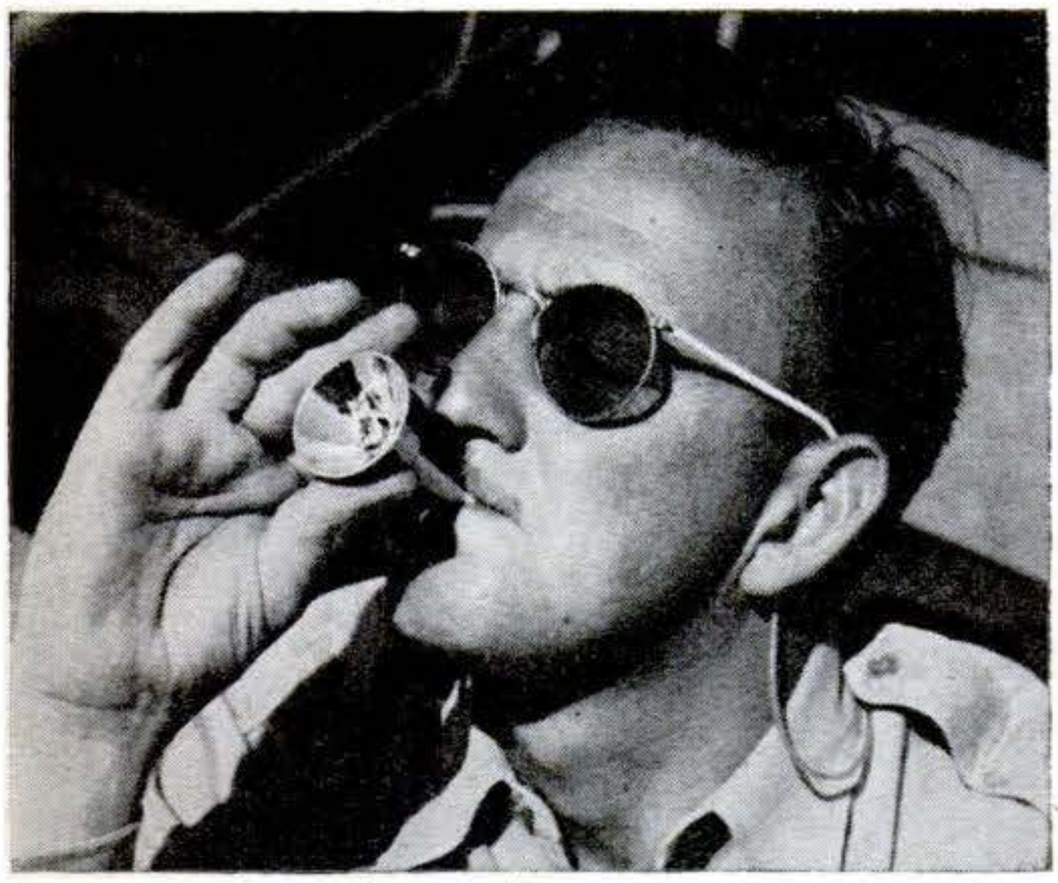
Washington Square Reading Center, New York

Now you can sample how much you remember of the useful and interesting information packed into this issue of POPULAR SCIENCE MONTHLY. Answers to the questions are printed just below the quiz. After each answer is a page reference to the article on which the question was based.

1. *C. P. Hornung, the auto artist, has painted models that go back as far as*

a. 1877
b. 1895
c. 1902

2. *This man is*



a. testing tobacco for tar
b. demonstrating a new oil filter
c. lighting a cigarette

3. *Air layering is a new method for*

a. growing plants without soil
b. testing metals
c. rooting plants

4. *Care in the Kaiser Hospital is not as expensive as it might be, because*

a. mass-production techniques are used
b. patients help take care of themselves
c. convalescence is accelerated

5. *The best-looking finish for walls paneled in fine woods is*

a. none at all
b. water-clear lacquer
c. flat varnish

6. *According to atomic scientists, the atomic pool envisioned by Pres. Eisenhower is most likely to consist of*

a. surplus fissionable materials
b. uranium and thorium ore
c. an exchange of atomic information

7. *Diesels for the White Pass & Yukon R.R. are specially made because of*

a. unbelievably steep grades
b. harsh weather
c. the roadbed's hairpin twists and turns

8. *The new solar furnace has uncovered two substances with melting points*

a. between 6,000 and 7,000 degrees
b. between 7,000 and 8,000 degrees
c. between 8,000 and 9,000 degrees

9. *The Eaton magnetic clutch employs as its magnetized agent*

a. fine iron particles in oil
b. fine copper particles in oil
c. a dry mix of iron and other particles

10. *With precast roadbeds and new car trucks, commuter trains could go up to*

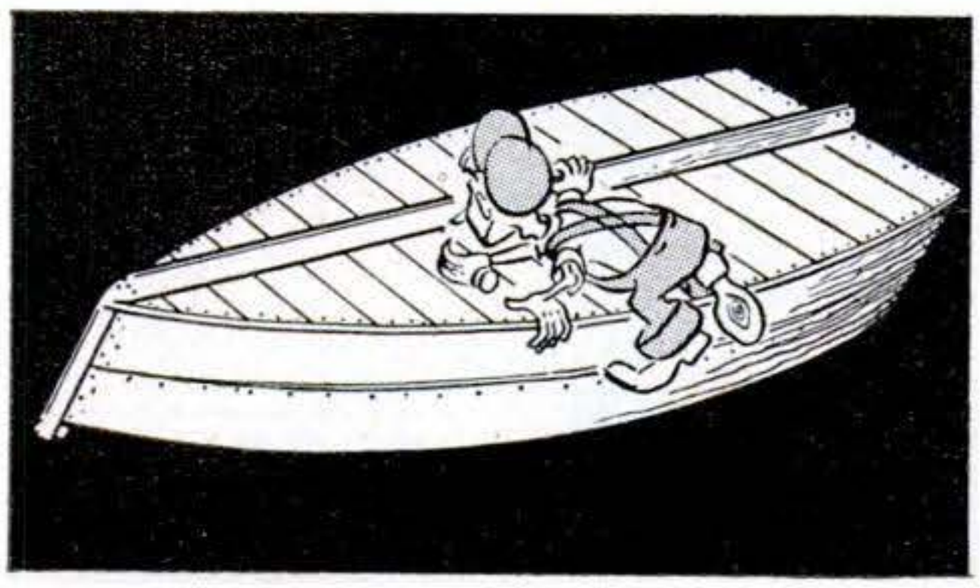
a. 75 miles per hour
b. 100 miles per hour
c. 150 miles per hour

Answers: 1. a—p. 107; 2. c—p. 129; 3. c—p. 227; 4. b—p. 126; 5. a—p. 203; 6. b—p. 101; 7. b—p. 164; 8. b—p. 129; 9. c—p. 148; 10. c—p. 120.

NEXT MONTH . . .

A Boat You Can Build

Anyone can build it, says the man who turned out the original and wrote the article about a small boat you'll see in the April issue of POPULAR SCIENCE MONTHLY. The lack of framing is the secret of its simplicity. It's a boat that will let you join in the fun of the crowd afloat this summer—with either oars or outboard.



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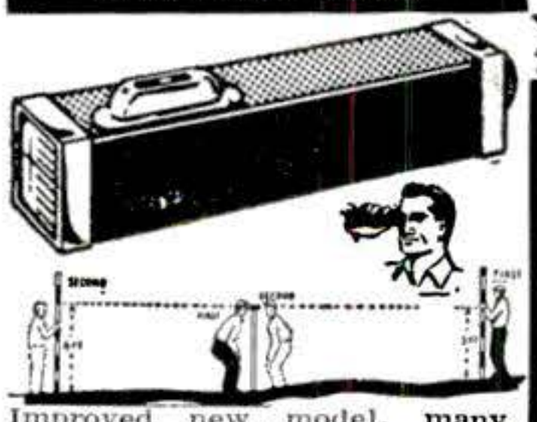
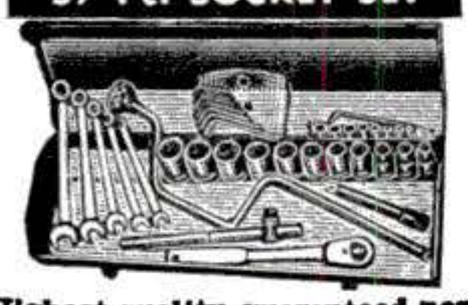
BUILDER'S HAND SIGHTING LEVEL



Improved new model, many uses. Establishing foundation lines, laying drains, ditches, roads, **terraces**, fences, etc. Extremely **accurate**. Tested by thousands **of** users. So simple **a** boy can use it. Indispensable **to Home** Mechanics, Carpenters, **Masons**, Contractors, Engineers, **Gardeners**. Complete with instructions. Item 312. Wt. 1 lb. Factory Special..... **$2.50**

37 Pc. SOCKET SET



Highest quality, guaranteed non-breakable sockets made by Husky. Beautifully matched chrome alloy. Absolutely the best. Complete range of 17 sockets from ¼" thru ½" (¼" drive) and 7/16" thru 1-1/16" (½" drive). 1 extension, reversible ½" ratchet, adapter bit, sliding "T" handle, "L" handle, ½" speeder, 5 pc. alloy combination wrench set, 8 pc. Allen wrench set, and a **big** doghouse tool box. We challenge anyone to match this value. Easily worth $41.95. Wt. 14 lb. (Item 59)..... **$16.95**

44 Pc. SOCKET SET

(Item 596) Same unconditionally guaranteed, non-breakable sockets as above—but with added sizes. Complete range of 21 sockets from ¼" thru 7/16" (¼" drive) & 7/16" thru 1-1/16" (½" drive). Two extensions, reversible ½" ratchet, 3 drift punches, sliding "T" head, all angle coupling, ½" speeder, ¼" breakover, 5 pc. high chrome alloy combination wrench set and 8 pc. offset wrench set in big doghouse tool box with ample room for other tools. Reg. $49.50 Wt. 16 lb..... **$21.95**

52 Pc. SOCKET SET

(Item 205) Contains a complete set of 28 sockets in ½" drive, ⅜" drive and ¼" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc.; all uncond. guaranteed against breakage. Beautiful matched chromed thin wall alloy sockets in a big, doghouse steel box. Wt. 17 lbs. List price $62.90 Factory Special..... **$27.95**

HEAVY DUTY D-C ARC WELDER

with mounting flange (Item 38)

Use as portable or shop welder. Up to 300 amps. Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily welds up to ¾" plate using ¼" rods. Built-in air cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 14 hp gas engine or 7 hp elec. motor. Complete with instructions, guar. and **triple V belt or flat** pulley. You can pay more, but you can't buy a better welder. (Item 38) Wt. 110 lbs. $400 value at.. **$99.75**

DUAL CONTROL MODEL same as above but with built-in dual rheostat for low heat soldering, brazing, welding. Special..... **$119.50**

BUY WHOLESALE DIRECT-FROM-FACTORY get DISCOUNTS UP TO 85%

PORTABLE LIGHT PLANTS

(Item 24)

PUSH BUTTON START A.C. LIGHT PLANT 600-700 watts—115 v.—60 cyc. A.C. Powered by a rugged 2 hp. easy-starting Briggs gas engine. No wiring necessary, just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts., trailers and camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Item 24. Wt. 75 lbs. *Be prepared if war or storm knocks out power lines.* Reg. $275 value.. **$143.50**

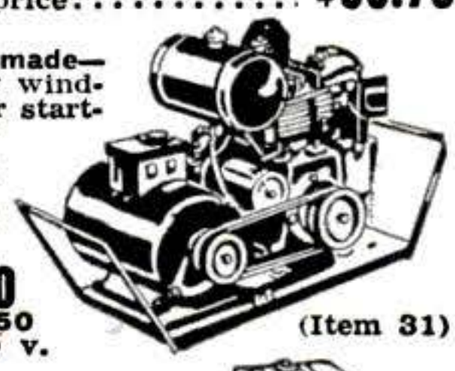
700-800 Watt Plant (Item 44) same as Item 24 but larger engine.... **$169.95**

1500-1700 Watt Plant (Item 20) — Similar to Item 24, but has three times more capacity. Wt. 173 lbs. Factory price..... **$279.50**

1000-1200 Watt Plant (Item 45) same as Item 24 but larger generator & engine.... **$199.50**

350 Watt Plant (Item 273) 115 v. D.C. 1½ hp. Briggs Engine. Perfect for lights, radios, small power tools Wt. 65 lbs. Factory price..... **$99.75**

GIANT 2000-2500 WATT PLANT



(Item 31)

110-120 V. 60 cyc. A.C. **Absolutely the best made**—exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid-mounted—portable. Powered by easy starting Briggs or 6 hp. Wisconsin engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and complete instructions included. (Item 31) Wt. 210 lbs. Reg. price $585.00. Special at **$299.50**

Generator Only and control box.....**$169.50**

3000-3500 WATT PLANT (Item 198) **110-220 v.** 60 cyc. A.C. Belt drive Wis. Engine. **Push button start.** Wt. 370 lbs. Heavy duty **$399.50**

Generator only for belt drive, Wt. 115 lbs. (Item 198A).....**$239.50**

(Item 21)

MASTER-LITE 2500 Watt Plant 110/120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button starter. Built-in winding to charge battery. Powered by a big 5.10 HP Briggs engine, complete with all accessories. Includes control box, voltmeter, and handy plug-in power receptacle. An ideal plant for permanent or stand-by service. Wt. 225 lb. Reg. price $645.00. Factory Price (Item 21) **$329.50**

3500 Watt Plant (Item 23) 115 v. 60 cyc. A.C. **Push Button Start.** Direct Drive. Wt. 270 lbs. Factory Price.....**$379.50**

(Item 162) HI-LINE 6000 WATT PLANT

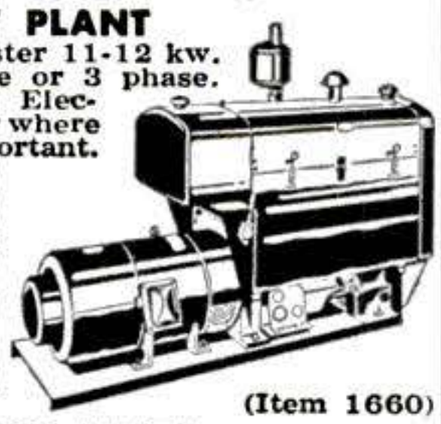
(Item 162)

Push Button Start, 115-230 v. 60 cycle A.C. A brute of a power plant with a rugged 14 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995.00. **With self starter.** Factory price..... **$645.00**

Same plant but **with Crank Start.** (Item 166)..... **$585.00**

Generator and control box only, belt driven. Use your own engine or tractor. Wt. 240 lbs. (Item 163) Factory price.. **$345.00**

DIESEL LIGHT PLANT



(Item 1660)

(Item 1660) Diesel Master 11-12 kw. 115/230 v. AC. Single or 3 phase. 1800 rpm. direct connected. Electric Self-starting. Engineered for permanent power where continuous low cost, heavy duty service is important. Wt. 1350 lbs. Reg. list $3650.00. Factory price..... **$1895.00**

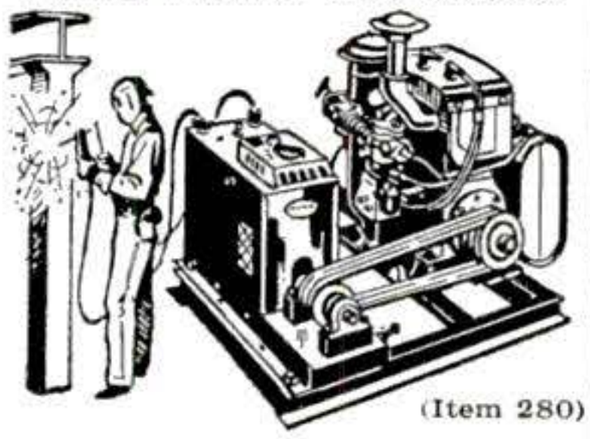
10-11 kw. **GAS DRIVEN PLANT.** 115-230 v. 60 cyc. AC. Single or 3 phase, powered by 4 cylinder Wisconsin air cooled engine. Belt driven. Constructed similarly to Hi-Line 6 KW shown above but much larger. (Item 217) (with crank start) Wt. 900 lb. Factory price **$1075.00**

Same plant with elec. self-starter....$1145.00

We make fully automatic controls to operate any of the above light plants. Write for details.

WE MAKE ALL SIZES UP TO 25,000 WATTS

POWER MASTER ARC WELDER



(Item 280)

Now! a portable, rugged, self-powered industrial type welder with terrific performance, yet at a price hundreds of dollars less than you'd expect. High capacity DC welding unit enables you to tackle any job with confidence—easily handles anything up to 2" plate using from 1/16" to ¼" rods. Built-in stabilizer and dual control simplifies any welding job from 30 to 250 amps. Welder is powered by 14HP 2 cylinder air cooled Wisconsin industrial engine with triple V-belt drive. Mounted on a welded steel chassis—easily transported on trailer or pick-up truck. Ideal for shop, factory or farm welding. Complete with instructions and guarantee. Wt. 480 lbs. Compares with welder costing $1200. (Item 280)

SPECIAL FACTORY PRICE $449.50

WELDING KIT Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at.....$10.50

MASTER AIR COMPRESSOR

COMPARE!—This is the only compressor built with a NO RUST stainless steel tank. Safe up to 500 lbs.!

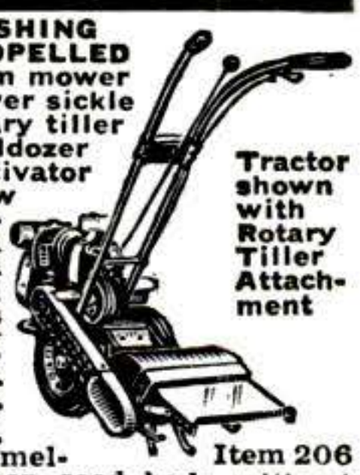
Tank Tested up to 500 lbs. per sq. in.

(Item 209) High pressure type for large volume of air for heavy duty service. For paint spraying, inflating truck & auto tires, greasing & the hundreds of other jobs done by compressed air. Piston type. 2" bore compressor with built-in air filter. Master built with high strength alloys and precision bearings. Tank, 12"x24", 2100 cu. in. cap. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 150 lbs.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Don't take chances with used or surplus equipment. Our compressors are factory new and are guaranteed **SAFE.** Low factory prices. With ⅓ HP., 110 v. AC motor. (Reg. $175) (Item 209p)..... **$109.50**

With ½ hp. motor. Reg. $199.50. (Item 209Ap)... **$129.50**

MASTER GARDENER

NO PUSHING
SELF-PROPELLED
It's a lawn mower
It's a power sickle
It's a rotary tiller
It's a bulldozer
It's a cultivator
It's a plow



Tractor shown with Rotary Tiller Attachment

Item 206

Where else can you get a power tool that does so many jobs? Works for you year 'round. Prepares mellowed, deep seed beds without labor. Built-in power take-off to drive pumps, saw, generators, etc. Safety clutch—can't burn out. More versatile and efficient than tractors costing twice as much. Converts in minutes to Tiller, Power Sickle, etc. Basic self-propelled 2 hp tractor. Briggs or Stratton famous engine..... **$119.50**

Rotary Tiller.....**$42.50**
Cultivator **$8.75**
Snow Blow.....**$29.50**
Disc Harrow.....**$15.75**
Furrowing Tool.....**$8.75**
Plow **$15.00**
Rotary Lawn Mower....**$42.50**
Sickle Bar Mower.....**$42.50**
Lawn Mower Hitch.....**$4.50**

Freight prepaid to most areas.
Easy payment plan available!

BIG ½" DRILL VALUE

½" DRILL and 29 Pc. drill set

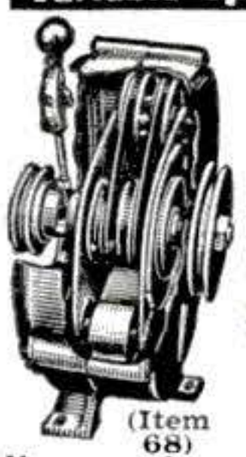
Now, a big production drill **at** an unheard of price. Heavy duty ½" drill with genuine Jacob's key chuck. Powerful, smooth — drills thru ½" steel with ease. 115v. AC-DC. Written 1 year guarantee. **Includes** a complete set of 29 tungsten vanadium speed drills from 1/16" to ½" by 1/64's in a permanent **steel index box.** Bits alone ordinarily sell for $35.00. Drill and bits — certified reg. price $87.50. Factory Special.. **$44.95** Item 33p Wt. 15 lbs.

DRILL BITS only, regular jobbers length, with index case. (Item 311d) Wt. 4 lbs. **$11.95**

Neoprene Extension Cord

(Item 185) Heavy duty, No. 14 - 2 conductor, very flexible. 20 yr. quality. Wt. 9 lbs. 100 ft. complete with rubber plug and outlet. A terrific buy.. **$8.95**

Variable Speed Selector



(Item 68)

Heavy duty, made by **B. F. GOODRICH** for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists — any operation requiring variable speed. Employs reliable "trouble - free" planetary system. No hydraulic power losses. Infinite range, smooth operation, easy installation. 3 sizes: ½-1 hp. wt. 36 lbs.; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. 105 lbs. Reg. list $228, $252 and $352. Our prices . . . **$79.50, $89.50 and $114.50.**

AIR COMPRESSOR ACCESSORIES

Pressure Gauge, range 0-160 lbs. ¼" pipe thread connection. 2" face.... **$1.50**

Check Valve, solid bronze, 200 lb. pressure. works in all positions. ¼" or ⅜" pipe threads, (specify)..... **$3.35**

Pressure Regulator, solid brass, std. ¼" pipe thrd., reduces any pressure to a range of 0-50..... **$3.75**

Pop (safety) Valve, adjustable from 0-200 lbs. ¼" pipe thread..... **$1.40**

SPECIAL all four above..$8.95

Send check or M.O. Prices f.o.b. Factory. 10 day Money back guarantee. SEND 10c for . . . BIG 1954 Catalog

MASTER MECHANIC MFG. CO., DEPT. 55E Burlington, Wis.

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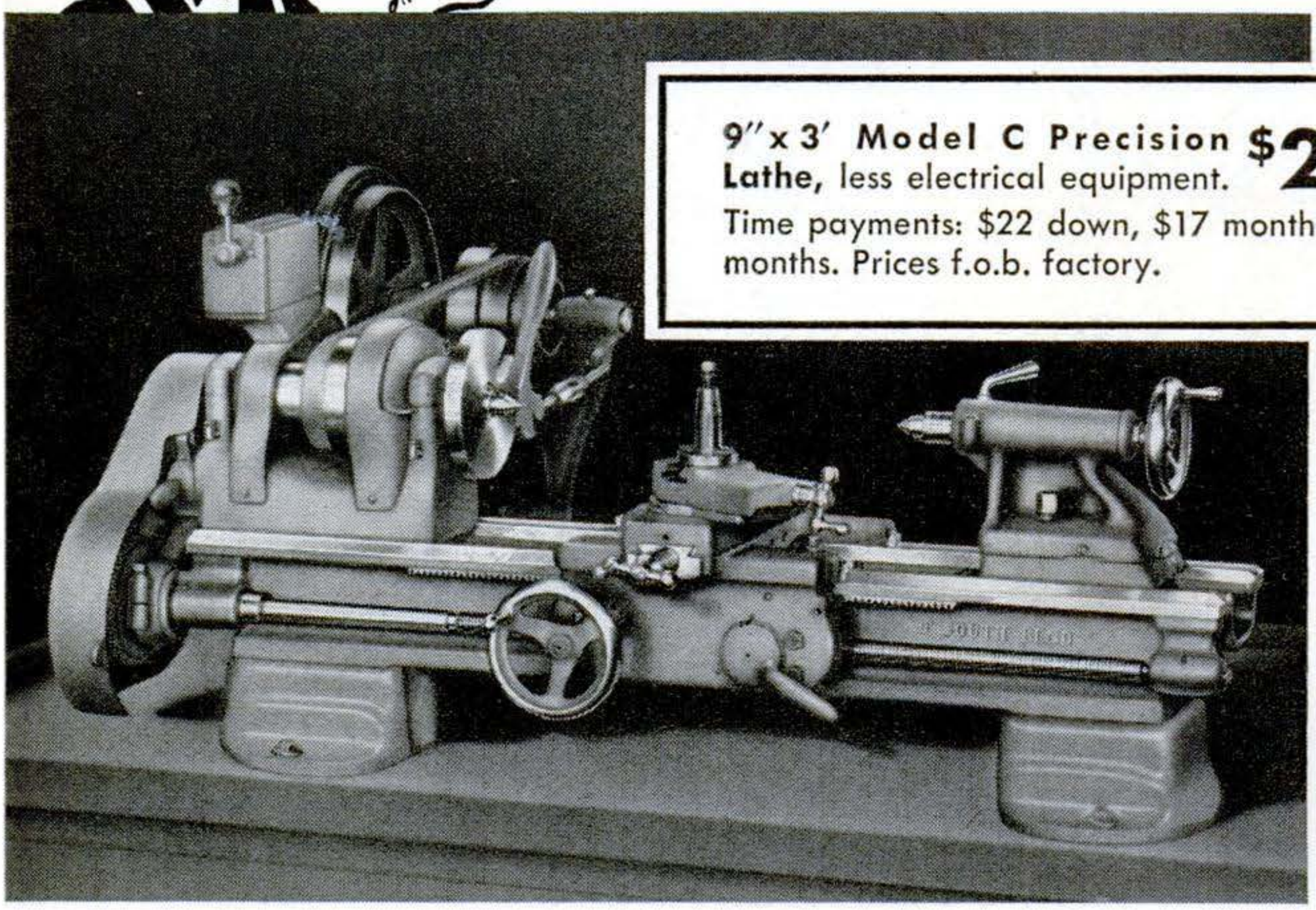
HERE IS A REAL SHOP VALUE

9″x 3′ Model C Precision Lathe, less electrical equipment. **$211.00**

Time payments: $22 down, $17 monthly, for 12 months. Prices f.o.b. factory.



HOW TO RUN A LATHE

Every lathe operator needs this popular reference handbook on lathe operation and care. 128 pages of helpful information. 365 illustrations. Send 50¢ for your copy.

Lathe values aren't measured in dollars. They are gauged by accuracy, versatility and dependable service. That's what makes South Bend 9″ Lathes such remarkable values — they give you more of what you actually need.

They are built to the same high standards and with the same skilled workmanship as larger South Bend Lathes. This makes them capable of precision work of all kinds in the small shop or close-tolerance production of small parts in the large manufacturing plant. Their versatility covers the entire range of lathe operations and is supplemented by numerous attachments available for special classes of work.

Compare these lathes with all others, regardless of price, and you'll see why you get more for your money in a South Bend.

Can I get it? When? How?

Yes—you can get most any South Bend product immediately from our distributor's stocks in principal cities. Items not stocked, shipped promptly from factory.

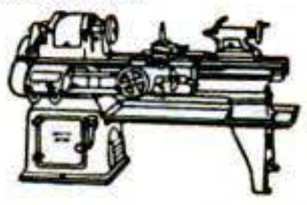
Three ways to order:

1. See or telephone nearest distributor.
2. Order by mail from your distributor.
3. If no distributor is nearby, order direct from factory.

South Bend machine tools with accessories may be purchased on convenient terms up to 18 months.

SEND INFORMATION CHECKED:

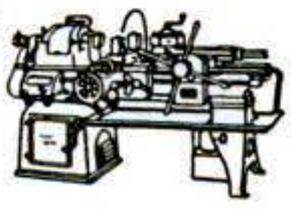
☐ 9″ and 10″ BENCH LATHES



☐ 10″ to 16-24″ FLOOR LATHES

☐ DRILL PRESSES

☐ TOOL GRINDERS



☐ ½″ & 1″ Collet TURRET LATHES

☐ 7″ BENCH SHAPERS

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Street_____ City & State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

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NOW READY! *A new educational program for the whole family..sponsored by* **THE NATIONAL AUDUBON SOCIETY**

In summer, the snowshoe rabbit is the same color as his tundra home. But when snow comes he begins to turn white—and soon he's camouflaged again!

Here are two unusual "look-alikes". One is the owl—and the other, the spectacular Calico Butterfly which often alights *upside down* with his "owl-eyes" showing! Nature "protects her own" with fascinating camouflage!

What will these unusual creatures grow up to be? You'd never guess!

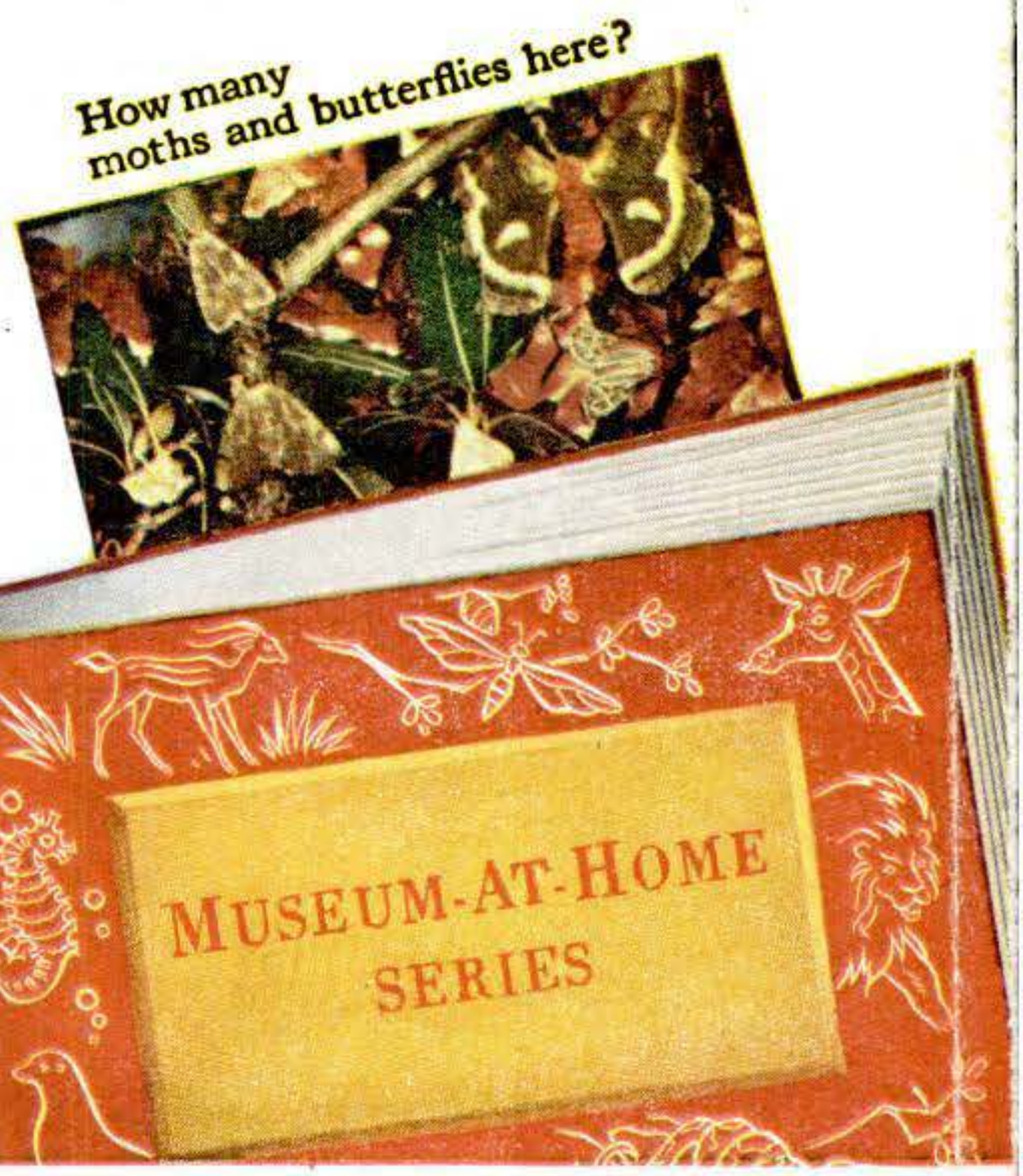
A fascinating NEW WAY to bring the WONDERS OF NATURE into your home!

MAGNIFICENT TRUE-TO-LIFE COLOR PRINTS AND INFORMATIVE ALBUMS THAT ARE AS EXCITING AS A VISIT TO A GREAT MUSEUM!

FREE if you enroll now

THE CURRENT ALBUM

CAMOUFLAGE IN NATURE



RIGHT NOW is an excellent time for you to find out about the National Audubon Society's revolutionary "Museum-at-Home" Nature Program. If you mail the post card at right you may have ABSOLUTELY FREE OF CHARGE the current set entitled CAMOUFLAGE IN NATURE, including thirty fascinating natural color prints plus an informative album in which to mount them. (Value $1.00)

This generous FREE gift is being offered to you as a *demonstration*—so that you and your family can discover how much pleasure and knowledge can be derived from this new and unique plan.

A Much-Needed Program

There is no subject more satisfying and worthwhile for young and old than the study of Nature. And the best way to undertake this fascinating quest would be in the personal company of friendly and inspired naturalists, such as those on the Staff of the National Audubon Society.

These scientists would show you the migrations of sea birds over thousands of miles of open water . . . let you discover how cleverly Nature "protects her own" with camouflage . . . explain to you the strange and almost unbelievable ways in which some animals reproduce, and rear their young. *Best of all, these naturalists would open your eyes to the wonders you can discover in your own back yard or park!*

An Amazing "Museum-at-Home"

The "Museum-at-Home" Nature Program was developed to bring to *your home* the closest possible equivalent to this kind of *thrilling personal guidance*. Each month a fascinating new topic is selected, and you and your family explore it together with the National Audubon Society's experts. For each topic, a collection of about thirty natural color prints—usually brilliant true color photographs—is issued, together with an album in which the prints (already gummed for this purpose) may be mounted. An interesting fact-filled text forms an important part of each set. It explains your "Museum-at-Home" exhibits, and gives you a wealth of other information. And the total cost is very low; only $1 for each set, plus a few pennies for shipping.

In addition, along with your first album you will be given a handsome maroon and gold color *protective case* in which your Nature Program sets may be kept. In almost no time your albums and color prints will rapidly grow into an "armchair museum" of Natural History! And this "museum" will be visited again and again through the years by the whole family and by friends. Begin your enrollment now with a Free Gift. Send the postage-free card—without money—today.

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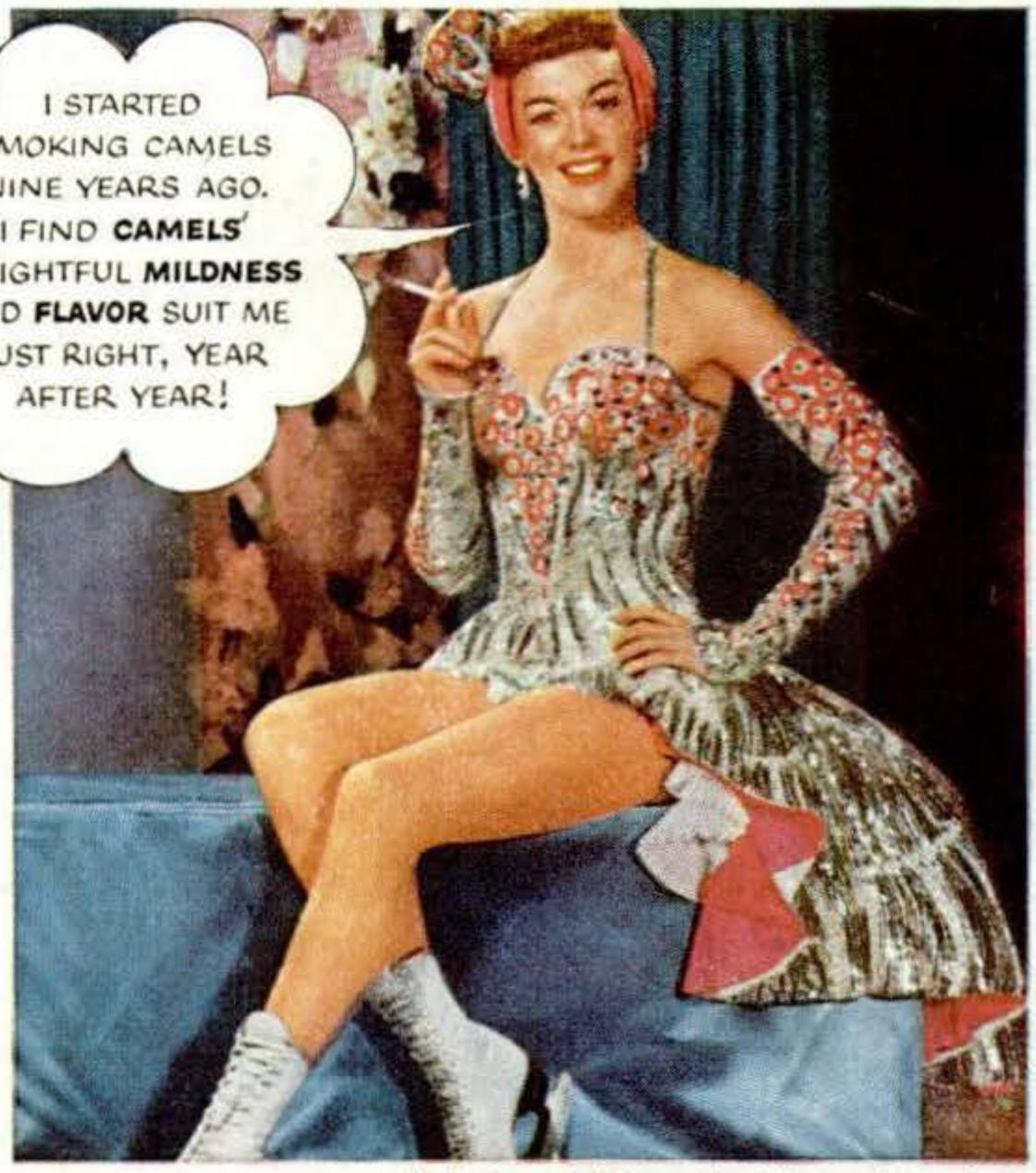

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